



2024 Nonpoint Source and Wetlands Section Focus Watershed Application Form

Final Deadline: January 3, 2025 at 5:00 pm

Applications must be submitted through eMACS

Applicant

Primary Contact

Title

Address

City

State

Zip Code

Phone Number

Email Address

Signature

Proposed Focus Watershed

Proposed HUC 10 Watershed

List the impaired waterbodies within the proposed HUC 10 watershed, along with their identified impairments from Montana's List of Impaired Waters. https://deq.mt.gov/files/Water/WQPB/CWAIC/Reports/IRs/2020/Appendix_A_Final.pdf

Waterbody

Impairment Causes

Water Quality Impairment Causes and Solutions

Describe the root cause of water quality problem(s) and the solution(s) needed to address the issue(s) within your proposed HUC 10 watershed. **(20 pts)**

Local Momentum and Organizational Capacity

Describe the current momentum that exists within the watershed for implementing the solution(s) described above. Describe the capacity of your organization and partners to administer focus watershed funds. **(20 pts)**

Anticipated Projects Use the table below to provide information on planned and proposed projects. The purpose of this information is to help determine local readiness to receive a significant influx of funding for projects. Projects do not need to be shovel-ready to be added to the table. Projects must restore and support native plants and animals and natural stream processes. Attach design drawings and other planning documents **where available.** (30 pts)

Project Name	Waterbody and Impairment to be Addressed	Planned BMPs and Quantity (<i>e.g., feet of fencing, miles of restored stream, acres restored wetlands, # and type of education and outreach events</i>)	List of Supporting Landowners and Partners	Estimated Total Project Cost	Design Drawings or Other Planning Documents Attached? (Y/N)
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Partners, Roles, Letters of Support Use the table below to identify specific landowners, funders, technical service providers, and other partners who will support you and your efforts to reduce nonpoint source pollution in your proposed HUC 10 watershed. **Attach letters of support from each partner.** Invite partners who provide a letter of support to provide insight into how they will contribute to the success of the focus watershed effort. **(20 pts)**

Name of Partner	Anticipated Role in Focus Watershed Effort	Letter of Support Attached?
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Environmental Justice

Describe your process for identifying, engaging, and providing access for disadvantaged communities to watershed funding, including involvement in the decision-making process and protection from environmental and health hazards within the watershed. **(10 pts)**

ATTACHMENTS

LETTERS
OF
SUPPORT



Local, Commonsense Conservation

5242 Highway 89 South
Livingston, MT 59047

406-946-3007
www.parkcd.org

12/10/2024

Montana Department of Environmental Quality
DEQ Headquarters
1520 E 6th Avenue
Helena, MT 59601

To whom it may concern,

The Park Conservation District (Park CD) and Shields Valley Watershed Group (SVWG) are pleased to support the 2024 application from Montana Freshwater Partners (MFP) to nominate the Lower Shields River Watershed as the next focus watershed for MT Department of Environmental Quality's 319 Nonpoint Source Project Funding Program for 2026-2028. This prioritized funding aligns with our shared mission to protect and restore Montana's freshwater resources while addressing the challenges involved with nonpoint source pollution as it pertains to watershed health.

The Shields River Watershed provides habitat for fish and wildlife, recreational opportunities, and water that supports local communities and agricultural operations. The Shields River Watershed also ranks second in terms of the amount of historically occupied habitat still supporting Yellowstone cutthroat trout, making its conservation essential for sustaining this species. However, the Shields River, from its headwaters to its confluence with the Yellowstone, is listed by Montana DEQ as an impaired waterbody. Primary causes of impairment include sedimentation and siltation, low flow alterations, and alterations to both streamside vegetative cover and in-stream habitat. Legacy impacts from the historic removal of beaver, agriculture practices, irrigation withdrawals, channel straightening and armoring, development, and more have collectively resulted in the severe impairment of the Shields River Watershed. This has had cascading effects on both the environment and local communities that depend on this resource. Thus, the potential to nominate the lowest sub-watershed of the Shields River for priority 319 funding offers a unique opportunity to implement collaborative restoration efforts and mitigate the impairments that the Shields River watershed faces.

The Park CD and SVWG recognize the need for increased and focused funding for the Lower Shields River watershed. We believe that the nomination and funding will have a transformative impact on not only the Lower Shields watershed, but also the communities that depend on its health.

Thank you for your consideration of this nomination.

Sincerely,

Kelly Arterburn
District Administrator
Park Conservation District

Ashley Lowrey
Watershed Coordinator
Shields Valley Watershed Group



Montana Fish, Wildlife & Parks
Region 3 Headquarters
1400 South 19th Street
Bozeman, MT 59715

December 20, 2024

Halle Nienhaus
Montana Freshwater Partners
215 E Lewis St.
Livingston, MT 59047

Montana Fish, Wildlife & Parks (FWP) appreciates the opportunity to comment on the nomination of the Lower Shields Watershed as the next DEQ 319 Focus Watershed.

In general, FWP is supportive of the proposal for the lower Shields to become a focus watershed for DEQ 319 funding. The lower Shields has several water quality impairments that could be addressed through focused funding. Addressing the impairments would improve both stream and riparian habitats, providing benefits for both fisheries and wildlife.

For any of the potential projects listed in the application, FWP would provide review and determine the level of support and partnership based on each individual project and potential improvement and benefits of that given project.

Any proposed development that may physically alter or modify the beds or banks is subject to approval and permitting by the local conservation district under Montana Code Annotated 75-7-101 (The Natural Streambed and Land Preservation Act of 1975; "310 Law").

For questions or concerns, please reach out to the following FWP personnel:

Scott Opitz, fisheries biologist (406-223-3951, sopitz@mt.gov)

Michael Yarnall, wildlife biologist (406-224-1162, Michael.yarnall@mt.gov)

Jen Smitham, Region 3 comment coordinator (406-495-3262, jsmitham@mt.gov)

Thank you again for the opportunity to comment.

Sincerely,

Nathan Lance

Nathan Lance
Acting Region 3 Supervisor



12/18/2024

Montana Department of Environmental Quality
DEQ Headquarters
1520 E 6th Avenue
Helena, MT 59601

To whom it may concern,

Trout Unlimited (TU) would like to express our support for Montana Freshwater Partners' 2024 application to nominate the Lower Shields River Watershed as the next focus watershed for MT Department of Environmental Quality's 319 Nonpoint Source Project Funding Program for 2026-2028. This prioritized funding will contribute greatly to the ability of TU, Montana Freshwater Partners, the Shields Valley Watershed Group, and other organizations to implement on the ground projects to decrease nonpoint source pollution and restore water quality, quantity, and aquatic habitat in the Shields River Watershed.

Trout Unlimited is a nationwide coldwater conservation organization conducting on the ground stream restoration projects across the country. TU has proven organizational capacity to put DEQ 319 priority watershed funding to use and has done so in other watersheds in Montana. The Shields River Watershed ranks second in terms of the amount of historically occupied habitat still supporting Yellowstone cutthroat trout and is included in TU's list of Priority Waters as part of the Yellowstone River Basin.

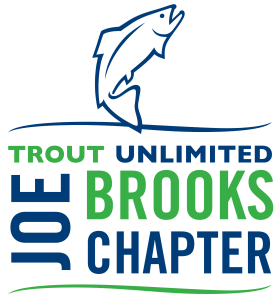
Trout Unlimited recognizes the need for increased and focused funding for the Lower Shields River Watershed. TU, Montana Freshwater Partners, and many other organizations and individuals are committed to collaborative efforts to implement on the ground restoration projects that work to improve water quality, quantity, and instream habitat in the Lower Shields River Watershed.

Thank you for your consideration of this nomination.

Sincerely,

A handwritten signature in black ink, appearing to read "Ashley Brubaker".

Ashley Brubaker
Upper Yellowstone/Shields River Project Manager
Trout Unlimited



Joe Brooks Chapter #025
Trout Unlimited
PO Box 88
Livingston, MT 59047
www.jbtu.org

December 11, 2024

Montana Department of Environmental Quality
DEQ Headquarters
1520 E 6th Avenue
Helena, MT 59601

OFFICERS

John Roseberry
President

Clifford David
Vice President

Tom Coleman
Treasurer

Charlie Eubank
Secretary

DIRECTORS

Derek Francisco
John Mills
Johnny Ryan
Melissa Stock

To whom it may concern,

Joe Brooks Trout Unlimited (JBTU) is pleased to support the 2024 application from Montana Freshwater Partners (MFP) to nominate the Lower Shields River Watershed as the next focus watershed for MT Department of Environmental Quality's 319 Nonpoint Source Project Funding Program for 2026-2028.

Much of the Shields River Watershed lies within our chapter's boundaries and the Lower Shields River has the potential to become valuable habitat for native Yellowstone Cutthroat Trout and to provide world-class recreation opportunities. Unfortunately, the Shields River and its tributaries are severely impacted due to historical removal of beavers, channel straightening and armoring, development, agricultural practices, and irrigation withdrawal. These impacts have collectively resulted in low stream flows, altered sediment transport processes and siltation, and degraded both instream habitat and riparian vegetation cover. Fortunately, there is enormous potential to make significant gains on the water quality, quantity, and overall ecological value of the Shields River through the collaborative, on-the-ground restoration projects outlined in MFP's application.

This prioritized funding aligns with JBTU's mission to restore and conserve coldwater fisheries within our chapter area and we recognize an urgent need for increased funding for the Lower Shields River focused at addressing the impairments created by nonpoint source pollution. JBTU is committed to building on our past collaborations with MFP and other organizations to support the implementation of restoration projects that work to improve the Lower Shields Watershed.

Furthermore, we believe that MFP is uniquely qualified to lead and implement a successful collaborative restoration effort that brings together diverse stakeholders from agriculture, conservation, recreation, and government in a way that will produce immensely beneficial results for the Lower Shields River Watershed.

JBTU believes that the successful nomination of the Lower Shields as a Focus Watershed will have a lasting positive impact on both the health of the river and the lives of the people that live, work, and recreate along the Shields River.

Thank you for your consideration of this nomination.

Sincerely,

John Roseberry

DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

Water Resources Division

1424 9th Ave, Helena, MT 59620-1601 Phone: (406) 444-6601 Fax: (406) 444-0533



GREG GIANFORTE, GOVERNOR

1539 ELEVENTH AVENUE

STATE OF MONTANA

DIRECTOR'S OFFICE: (406) 444-2074
FAX: (406) 444-2684

PO BOX 201601
HELENA, MONTANA 59620-1601

December 17, 2024

Montana Department of Environmental Quality
DEQ Headquarters
1520 E 6th Avenue
Helena, MT 59601

Re: Support for Designation of the Lower Shields Watershed as the focus watershed for MT DEQ 319 Nonpoint Source Project Funding 2026-2028

Dear Members of the Review Committee,

The Montana DNRC's Planning, Implementation, and Communications Bureau of the Water Resources Division is in full support of the 2024 application from Montana Freshwater Partners (MFP) nominating the Lower Shields River Watershed as the next focus watershed for MT Department of Environmental Quality's 319 Nonpoint Source Project Funding Program for 2026-2028. Prioritization of the Lower Shields River Watershed will significantly advance our shared mission to protect and restore Montana's freshwater resources by promoting collaborative efforts to address nonpoint source pollution and watershed health.

The Shields River Watershed provides habitat for fish and wildlife, recreational opportunities, and water that supports local communities and agricultural operations. The Shields River Watershed also ranks second in terms of the amount of historically occupied habitat still supporting Yellowstone cutthroat trout, making its conservation essential for sustaining this species. However, the Shields River, from its headwaters to its confluence with the Yellowstone, is listed by Montana DEQ as an impaired waterbody. Primary causes of impairment include sedimentation and siltation, low flow alterations, and alterations to both streamside vegetative cover and in-stream habitat. This has cascading effects on both the environment and local communities. Prioritization of the Lower Shields River watershed for 319 funding represents an opportunity to implement restoration efforts to address existing and mitigate further impairment of the entire Shields River.

Montana DNRC recognizes the need for focused efforts to restore and protect the Lower Shields River watershed. We are committed to collaborating on the development, implementation, and communication of restoration projects to improve water quality in the Lower Shields watershed. Designating the Lower Shields River watershed as the 2026-2028 priority area for 319 funding will have a transformative impact on the watershed, surrounding ecosystem, and local communities.

Thank you for consideration of this nomination.

Sincerely,

A handwritten signature in black ink, appearing to read "Sale Rhodes". The signature is written in a cursive style with a large initial "S" and "R".

Sale Rhodes

Yellowstone River Regional Water Planner

Montana Department of Natural Resources and Conservation

12/19/2024

Montana Department of Environmental Quality
DEQ Headquarters
1520 E 6th Avenue
Helena, MT 59601

To whom it may concern,

I am writing to express my support of the 2024 Request for Information (RFI) from Montana Freshwater Partners (MFP) to the Montana Department of Environmental Quality (DEQ) for the nomination of the Lower Shields River (HUC10) Watershed as the next focus watershed for 2026-2028. As a farmer living on two tributaries and depending on the Shields River for irrigation, I know firsthand the importance of the Shields River watershed to our community, livelihood, and the ecological health and resilience of the region.

The Shields River is not simply a water source for agriculture, livestock, and wildlife; it is the backbone of our way of life in the Shields Valley. The Shields River and its tributaries support drinking water for local communities, water that supports the local agricultural economy, and recreational opportunities for the community. Improvements to the water quality and health of the Shields River watershed as a whole help ensure that our watershed remains functional and resilient into the future. Thus, the potential to nominate the lowest sub-watershed of the Shields River for priority 319 funding offers an excellent opportunity to implement highly collaborative restoration efforts and effectively mitigate the impairments that the Shields River watershed faces as a whole. These efforts would improve and ensure our watershed's resilience for generations to come.

The need for adequate funding to support these restoration projects is urgent. Many ranchers, farmers, and landowners, like myself, are committed to working with organizations like Montana Freshwater Partners and Trout Unlimited to restore and protect these natural resources. However, the costs associated with these efforts can be prohibitive without sufficient financial support. As such, I firmly believe that the nomination and funding will have a transformative impact on not only the Lower Shields watershed, but also the communities and landowners that depend on its health.

Thank you for your consideration of this nomination.

Sincerely,

Jennifer Vermillion
Park County Commissioner Elect
Shields Valley Resident

December 9, 2024

Montana Department of Environmental Quality
DEQ Headquarters
1520 E 6th Avenue
Helena, MT 59601

Dear Sir or Madam,

I am writing to express my support of the 2024 Request for Information (RFI) from Montana Freshwater Partners (MFP) to the Montana Department of Environmental Quality (DEQ) for the nomination of the Lower Shields River (HUC10) Watershed as the next focus watershed for 2026-2028. As a landowner, I see firsthand the importance of the Shields River and its tributaries to our community, livelihood, and the ecological health and resilience of the region.

The Shields River is not simply a water source for agriculture, livestock, and wildlife; it is the backbone of our way of life in the Shields Valley. The Shields River and its tributaries support drinking water for local communities, water that supports the local agricultural economy, and recreational opportunities for the community. Improvements to the water quality and health of the Shields River watershed as a whole help ensure that our watershed remains functional and resilient into the future. Thus, the potential to nominate the lowest sub-watershed of the Shields River for priority 319 funding offers an excellent opportunity to implement highly collaborative restoration efforts and effectively mitigate the impairments that the Shields River watershed faces as a whole. These efforts would improve and ensure our watershed's resilience for generations to come.

The need for adequate funding to support these restoration projects is urgent. Many ranchers, farmers, and landowners, like myself, are committed to working with organizations like Montana Freshwater Partners and Trout Unlimited to restore and protect these natural resources. However, the costs associated with these efforts can be prohibitive without sufficient financial support. As such, I firmly believe that the nomination and funding will have a transformative impact on not only the Lower Shields watershed, but also the communities and landowners that depend on its health.


Thank you for your consideration of this nomination.

Sincerely,



Michael P Atkinson
CrazyA Ranch
100 Cooper Lane
PO Box 207
Clyde Park, Montana

P.S. I have worked with MT Freshwater Partner and can attest to their integrity & competence.



12/17/2024

Montana Department of Environmental Quality
DEQ Headquarters
1520 E 6th Avenue
Helena, MT 59601

To whom it may concern,

I am writing to express my support of the 2024 Request for Information (RFI) from Montana Freshwater Partners (MFP) to the Montana Department of Environmental Quality (DEQ) for the nomination of the Lower Shields River (HUC10) Watershed as the next focus watershed for 2026-2028. As a rancher, I see firsthand the importance of the Shields River and its tributaries to our community, livelihood, and the ecological health and resilience of the region.

The Shields River is not simply a water source for agriculture, livestock, and wildlife; it is the backbone of our way of life in the Shields Valley. The Shields River and its tributaries support drinking water for local communities, water that supports the local agricultural economy, and recreational opportunities for the community. Improvements to the water quality and health of the Shields River watershed as a whole help ensure that our watershed remains functional and resilient into the future. Thus, the potential to nominate the lowest sub-watershed of the Shields River for priority 319 funding offers an excellent opportunity to implement highly collaborative restoration efforts and effectively mitigate the impairments that the Shields River watershed faces as a whole. These efforts would improve and ensure our watershed's resilience for generations to come.

The need for adequate funding to support these restoration projects is urgent. Many ranchers, farmers, and landowners, like myself, are committed to working with organizations like Montana Freshwater Partners and Trout Unlimited to restore and protect these natural resources. However, the costs associated with these efforts can be prohibitive without sufficient financial support. As such, I firmly believe that the nomination and funding will have a transformative impact on not only the Lower Shields watershed, but also the communities and landowners that depend on its health.

Thank you for your consideration of this nomination.

Sincerely,

Tim Niccum
General Manager, VIG Hayhook Ranch LLC
Shields Valley Resident

File Code: 2520
Date: December 23, 2024

Montana Department of Environmental Quality
DEQ Headquarters
1520 E 6th Avenue
Helena, MT 59601

To whom it may concern:

The Yellowstone Ranger District of the Custer Gallatin National Forest is pleased to support the 2024 application from Montana Freshwater Partners (MFP) to nominate the Lower Shields River Watershed as the next focus watershed for MT Department of Environmental Quality's 319 Nonpoint Source Project Funding Program for 2026-2028. This prioritized funding aligns with our shared mission to protect and restore Montana's freshwater resources while addressing the challenges involved with nonpoint source pollution as it pertains to watershed health. It also supports the goals and objectives of the Interstate Conservation Agreement and Strategy for Yellowstone Cutthroat Trout to which the Forest Service is signatory.

The Shields River Watershed provides habitat for fish and wildlife, recreational opportunities, and water that supports local communities and agricultural operations. The Shields River Watershed also ranks second in terms of the amount of historically occupied habitat still supporting our native Yellowstone cutthroat trout, making its conservation essential for sustaining this species. However, the Shields River, from its headwaters to its confluence with the Yellowstone, is listed by Montana DEQ as an impaired waterbody. Primary causes of impairment include sedimentation and siltation, low flow alterations, and alterations to both streamside vegetative cover and in-stream habitat. Legacy impacts from the historic removal of beaver, agriculture practices, irrigation withdrawals, channel straightening and armoring, development, and more have collectively resulted in the severe impairment of the Shields River Watershed.

Since 2008, the Custer Gallatin National Forest and partners have invested over \$7 million to restore the upper Shields River Watershed on National Forest system lands. This has included reshaping and graveling 28 miles of roadway and closing and restoring over 50 miles of excess roads to reduce sediment loading in the mainstem Shields and tributary streams to improve water quality. In addition, the Forest replaced 23 undersized, perched stream crossing structures with Aquatic Organism Passage Structures to restore habitat connectivity for Yellowstone cutthroat trout and other aquatic species. Finally, three concrete fish barriers were installed to secure over 40 miles of Yellowstone cutthroat trout stream habitat from competition and hybridization with nonnative fish.

With most aquatic habitat impairment issues in the upper watershed resolved, the Forest Service recognizes the need for increased focus on the Lower Shields River watershed to address the



myriad water quality, water quantity, and aquatic habitat impairments outlined in the Yellowstone Cutthroat Trout Conservation Strategy for the Shields River Watershed Above Chadbourne Diversion. Because watersheds transcend jurisdictional boundaries, the Yellowstone Ranger District greatly values MFP efforts to bring together a diverse group of water resource professionals and landowners to collaboratively prioritize, plan, and implement watershed restoration projects in the Lower Shields Watershed.

Thus, nominating the lowest sub-watershed of the Shields River for priority 319 funding offers a unique opportunity to implement highly collaborative restoration efforts and effectively mitigate the impairments that the Shields River watershed faces as a whole. These efforts would improve and ensure the watershed's resilience for generations to come.

In addition to Montana Freshwater Partners, the Forest Service and many others are committed to collaborative and partnered efforts to implement on the ground restoration projects that work to improve water quality in the Lower Shields watershed. As such, we firmly believe that the nomination and funding will have a transformative impact on not only the Lower Shields watershed, but also the communities that depend on its health.

Thank you for your consideration of this nomination.

Sincerely,

ZACHARY FISHER
Acting District Ranger



December 5, 2024

Montana Department of Environmental Quality
DEQ Headquarters
1520 E 6th Avenue
Helena, MT 59601

To whom it may concern,

Restoration Engineering, LLC (RE) is pleased to support the 2024 application from Montana Freshwater Partners (MFP) to nominate the Lower Shields River Watershed as the next focus watershed for MT Department of Environmental Quality's 319 Nonpoint Source Project Funding Program for 2026-2028. This prioritized funding aligns with our shared mission to protect and restore Montana's freshwater resources while addressing the challenges involved with nonpoint source pollution as it pertains to watershed health.

The Shields River Watershed provides habitat for fish and wildlife, recreational opportunities, and water that supports local communities and agricultural operations. The Shields River Watershed also ranks second in terms of the amount of historically occupied habitat still supporting Yellowstone cutthroat trout, making its conservation essential for sustaining this species. However, the Shields River, from its headwaters to its confluence with the Yellowstone, is listed by Montana DEQ as an impaired waterbody. Primary causes of impairment include sedimentation and siltation, low flow alterations, and alterations to both streamside vegetative cover and in-stream habitat. Legacy impacts from the historic removal of beaver, agriculture practices, irrigation withdrawals, channel straightening and armoring, development,, and more have collectively resulted in the severe impairment of the Shields River Watershed. This has had cascading effects on both the environment and local communities that depend on this resource. Thus, the potential to nominate the lowest sub-watershed of the Shields River for priority 319 funding offers a unique opportunity to implement highly collaborative restoration efforts and effectively mitigate the impairments that the Shields River watershed faces as a whole. These efforts would improve and ensure the watershed's resilience for generations to come.

Restoration Engineering recognizes the need for increased and focused funding for the Lower Shields River watershed. In addition to Montana Freshwater Partners, RE and many others are committed to collaborative and partnered efforts to implement on the ground restoration projects that work to improve water quality in the Lower Shields watershed. As such, we firmly believe that the nomination and funding will have a transformative impact on not only the Lower Shields watershed, but also the communities that depend on its health.

Thank you for your consideration of this nomination.

Sincerely,

A handwritten signature in blue ink, appearing to read "Tom Coleman", is written over the typed name.

Tom Coleman, PE
Principal Engineer
Restoration Engineering, LLC

December 19, 2024

Montana Department of Environmental Quality
DEQ Headquarters
1520 E 6th Avenue
Helena, MT 59601



To whom it may concern,

Gallatin Valley Land Trust (GVLTr) is pleased to support the 2024 application from Montana Freshwater Partners (MFP) to nominate the Lower Shields River Watershed as the next focus watershed for MT Department of Environmental Quality's 319 Nonpoint Source Project Funding Program for 2026-2028.

The Gallatin Valley Land Trust connects people, communities, and open lands through conservation of working farms and ranches, healthy rivers, and wildlife habitat, and the creation of trails in the Montana headwaters of the Missouri and Upper Yellowstone Rivers. This prioritized funding aligns with our shared vision of protecting and restoring Montana's freshwater resources and watershed health.

The Shields River Watershed provides habitat for fish and wildlife, recreational opportunities, and water that supports local communities and agricultural operations. The Shields River Watershed also ranks second in terms of the amount of historically occupied habitat still supporting Yellowstone cutthroat trout, making its conservation essential for sustaining this species. However, the Shields River, from its headwaters to its confluence with the Yellowstone, is listed by Montana DEQ as an impaired waterbody.

Recognizing the threat that unplanned development has on our natural resources, including water quality and quantity, GVLTr has partnered with local families in the region to conserve over 72,000 acres. In 2022 GVLTr was the lead partner on a Regional Conservation Partnership Program grant awarded through the NRCS to accelerate the pace of conservation and restoration in the Upper Yellowstone Watershed in southern Park County. In 2024, GVLTr applied for additional funding and expanded that project area to include the Shields Watershed. GVLTr recognizes the need for increased and focused funding in this landscape. In addition to Montana Freshwater Partners, GVLTr and our community partners are committed to collaborative efforts to implement on the ground conservation and restoration projects that work to improve water quality in the Lower Shields watershed. As such, we firmly believe that the nomination and funding will have a transformative impact on not only the Lower Shields watershed, but also the communities that depend on its health.

Thank you for your consideration of this nomination.

Sincerely,

A handwritten signature in black ink, appearing to read "Cole Herdman".

Cole Herdman
Park County Program Manager
Gallatin Valley Land Trust



**PLANNING
AND
DESIGN
DOCUMENTS**

BRACKETT CREEK RESTORATION AVIS REACH

PROJECT LOCATION

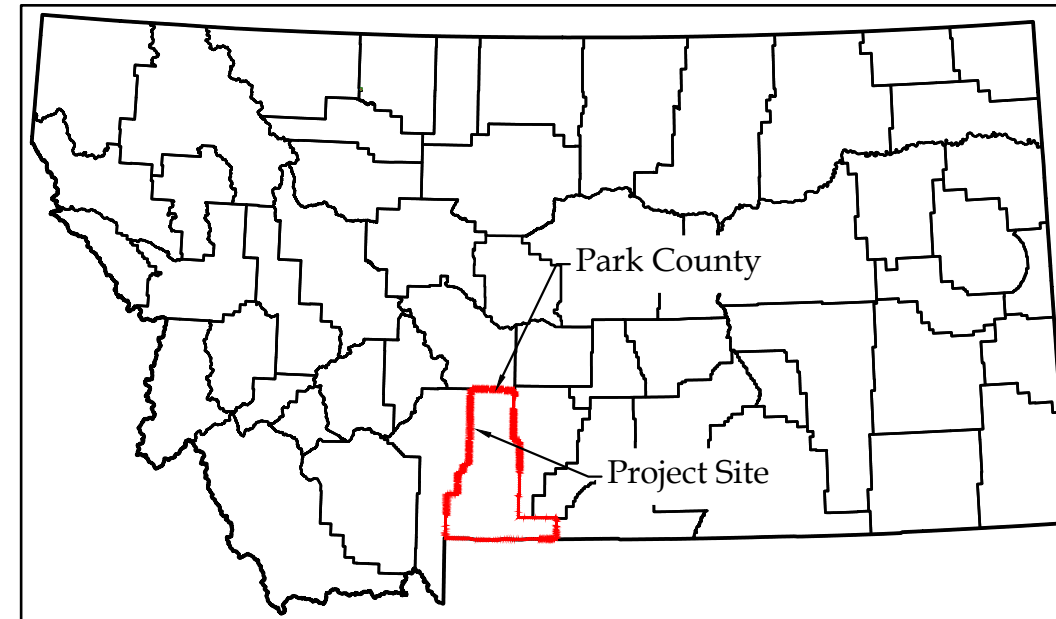
LOCATED IN PARK COUNTY AT 545 BRACKETT CREEK ROAD, CLYDE PARK, MONTANA

AT

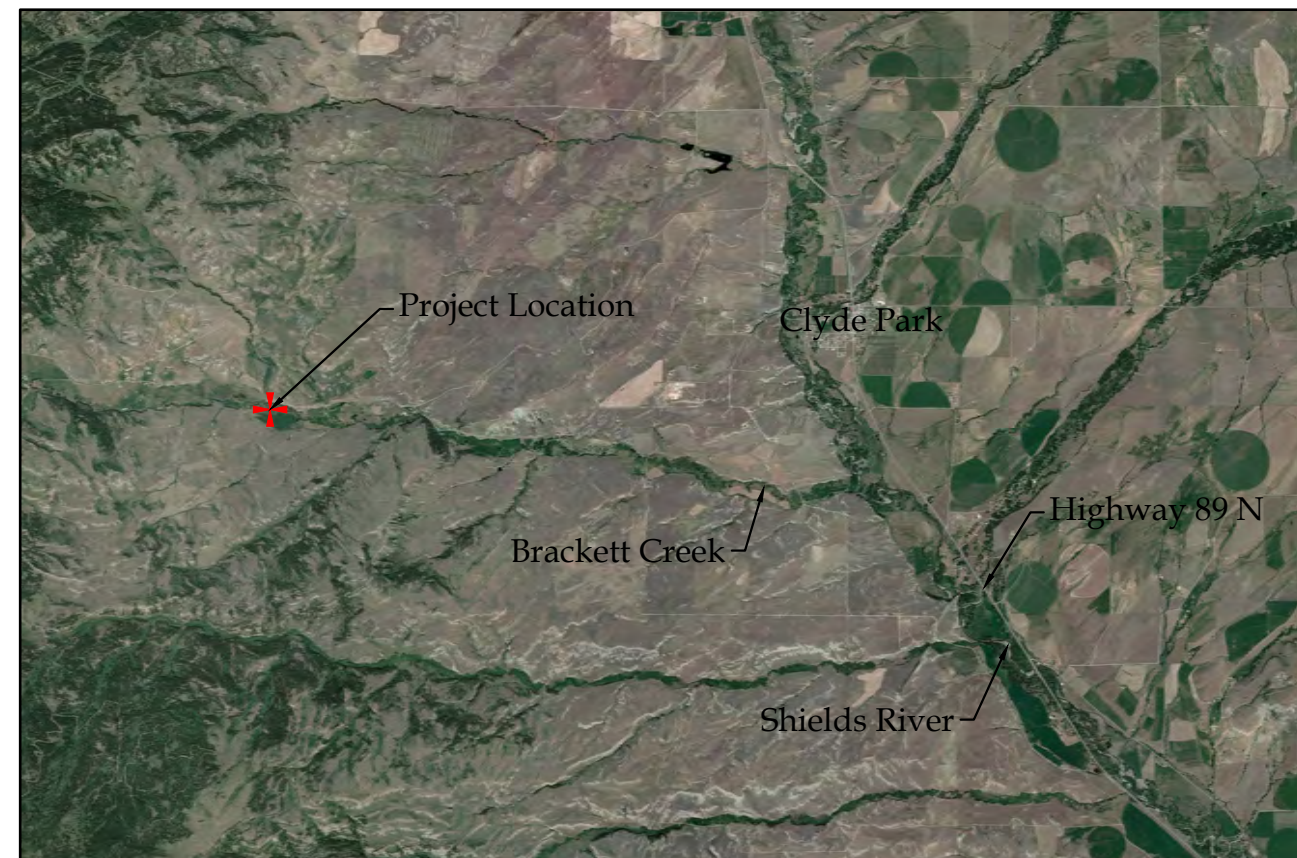
S $\frac{1}{2}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$ OF SECTION 34, N $\frac{1}{2}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ OF SECTION 3, AND N $\frac{1}{2}$, NE $\frac{1}{4}$ & NW $\frac{1}{4}$ OF SECTION 3, TWP 2N, RANGE 8E

LATITUDE = 45° 52' 20" NORTH; LONGITUDE = 110° 43' 20" WEST

PROJECT SPONSOR: TROUT UNLIMITED



VICINITY MAP



PROJECT SITE MAP

Scale: 1" = 5,000'

SHEET INDEX:

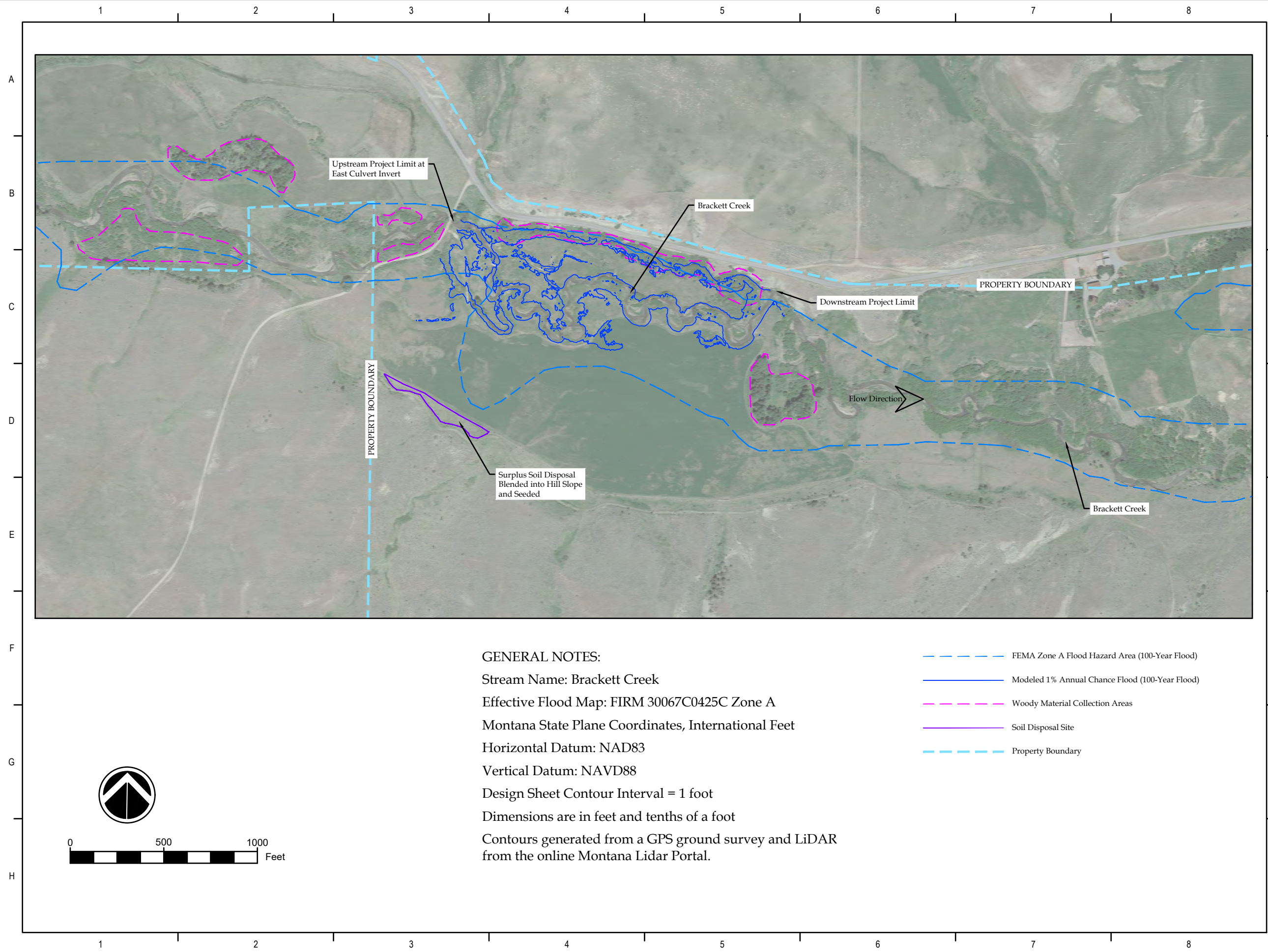
- 1 VICINITY MAP & SHEET INDEX
- 2 EXISTING CONDITIONS PLAN & PROFILE VIEW
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- 12 WOOD TOE CROSS SECTION DETAIL & TYPE III TREATMENT
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- 20 PHOTOS



VICINITY MAP AND SHEET INDEX
BRACKETT CREEK RESTORATION
AVIS PROPERTY

NO.	DATE	DESCRIPTION

PROJECT NO: 0622-01
DESIGNED: TC DRAWN: TC CHECKED: TC
PROJECT NO: DATE: 1/31/2024
FIGURE: 1



GENERAL NOTES:
 Stream Name: Brackett Creek
 Effective Flood Map: FIRM 30067C0425C Zone A
 Montana State Plane Coordinates, International Feet
 Horizontal Datum: NAD83
 Vertical Datum: NAVD88
 Design Sheet Contour Interval = 1 foot
 Dimensions are in feet and tenths of a foot
 Contours generated from a GPS ground survey and LiDAR from the online Montana Lidar Portal.

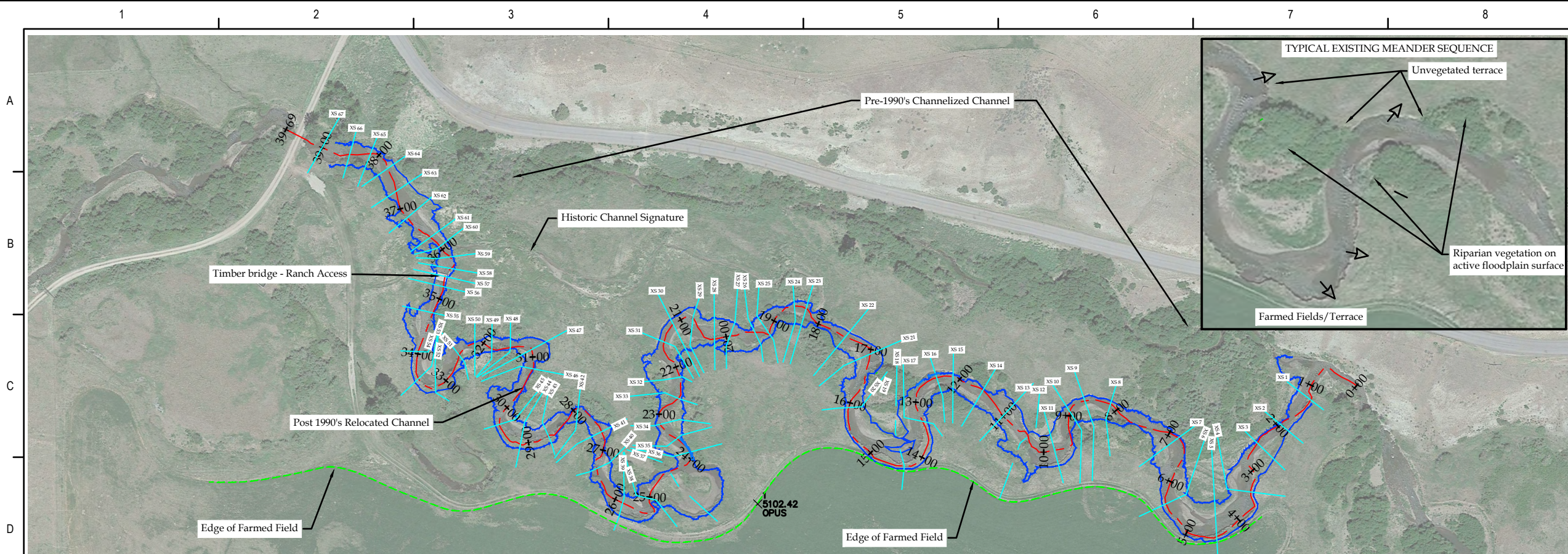
- - - - - FEMA Zone A Flood Hazard Area (100-Year Flood)
- Modeled 1% Annual Chance Flood (100-Year Flood)
- - - - - Woody Material Collection Areas
- Soil Disposal Site
- - - - - Property Boundary



PROJECT AREA OVERVIEW
BRACKETT CREEK RESTORATION
AVIS PROPERTY

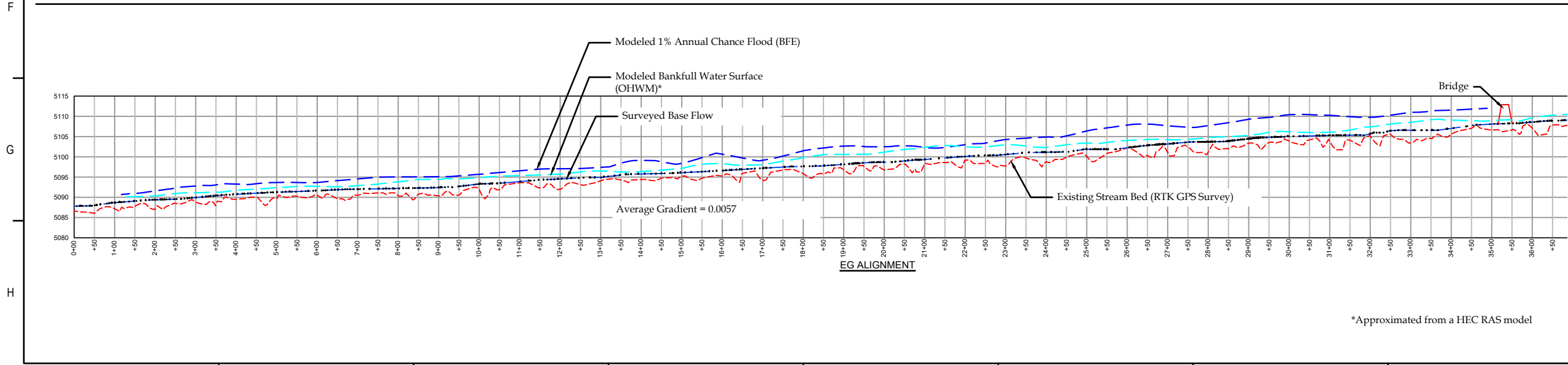
NO.	DATE	DESCRIPTION

PROJECT NO: 0323-2
 DESIGNED: TC DRAWN: TC CHECKED: TC
 PROJECT NO: DATE: 01/31/24
 SHEET NO: 2



Existing Condition Description:
 Impairments to the project reach of Brackett Creek are largely a result historic agricultural land use practices. Prior to the 1990's, the stream had been channelized and confined to a constructed channel along the base of the county road to the North. The stream was relocated to a historic channel in the 1990s, but haying operations continued on both sides of the stream corridor, which is relatively narrowly bounded by terrace surfaces. The project reach is actively laterally increasing its channel corridor or belt width where it meanders into the high terrace surfaces. The rate of erosion at these river meanders is high as evidenced by a corresponding wide, shallow cross-section. Terraces are susceptible to erosion due to an absence of deep rooted riparian vegetation and due to high bank height ratios that increase gravitational collapse processes. In the vicinity of rapidly retreating banks, bedform and habitat diversity are low and high width to depth cross sections are less efficient at transporting sediment resulting in central bar formation that further drives erosion. The high terrace erosion sites are generally at the edges of the active channel corridor, so further lateral migration will continue move the channel into lightly vegetated surfaces making natural system recovery a slow and messy process. Conversely, within the project reach, where channel meanders correspond to vegetated floodplain surfaces (low bank height ratios), the associated channel cross-section is relatively deep and narrow and efficient at transporting sediment. Near the upstream limit of the project reach a timber bridge has historically provided access to pasture on the North side of the creek. The bridge is a substantial constriction to the channel and it forces water to flow over bank at flows lower than would naturally access the floodplain.

- Ordinary High Water Mark (OHWM)
- Active Bank Erosion - 1905 feet
- XS ## Cross Sections
- ##+## Channel Centerline Alignment



*Approximated from a HEC RAS model



**EXISTING CONDITIONS
 PLAN & PROFILE VIEW
 BRACKETT CREEK RESTORATION
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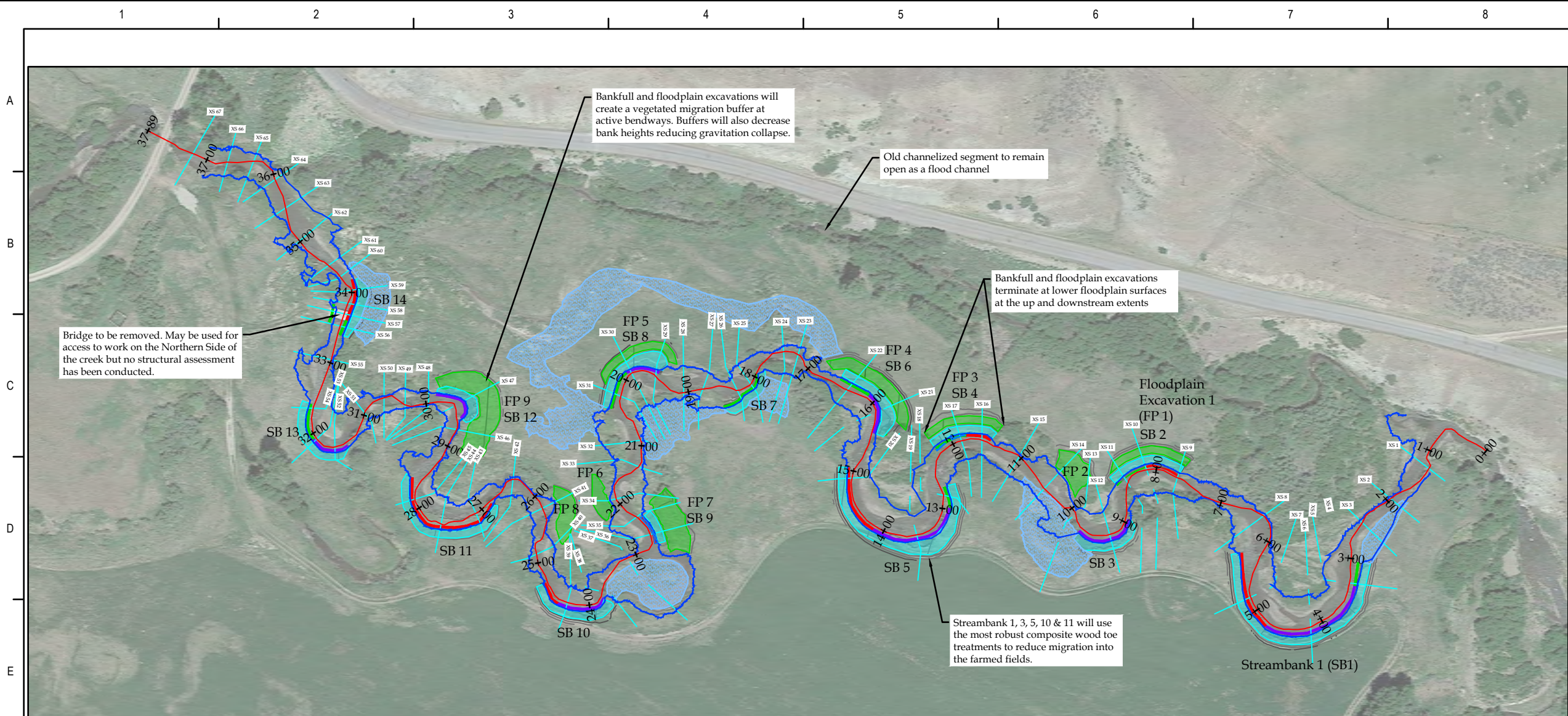
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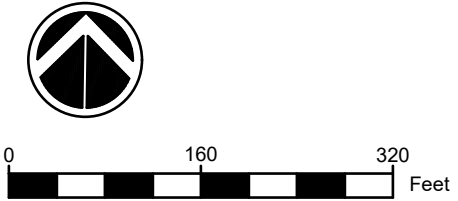
PROPOSED PROJECT ELEMENTS
BRACKETT CREEK RESTORATION
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- ##+## Channel Centerline Alignment
- No-Excavation - Revegetation Areas (1.05 Acres)
- Floodplain Excavations/Fills (0.51 Acres)
- Bankfull Bench Excavations (0.87 Acres)
- Bank Treatment Type I - 830 feet (Sheet 11 - 13)
- Bank Treatment Type II - 615 feet (Sheet 11 - 13)
- Bank Treatment Type III - 275 feet (Sheet 12)

PROJECT NARRATIVE:
 The project seeks to expand the stream corridor belt width at meanders that are actively eroding into lightly vegetated high terrace banks. In doing so, a riparian buffer will be created to slow erosion rates, but also provide lateral space/distance to prevent reactivation of high terrace erosion in the event of eventual migration through bank treatments. The proposed project action includes two or three main features at each site; 1) Bank treatment, 2) Bankfull bench creation, and 3) Floodplain bench creation. At each bank site, one of three bank treatments are specified at each station along the bank. One or all of the treatments may be used at each project bank depending on local characteristics including radius of curvature, shear stress and bank material composition. Bank restoration treatments are intended to create a more stable channel margin that will slow erosion on a time scale that allows planted and volunteer riparian vegetation to become established. Treatments use naturally occurring sod, trees, shrubs, and brush and alluvium. The second feature at each project site is creation of a bankfull bench. Self-formed alluvial channels renew their riparian areas through erosion and deposition. Therefore, future channel migration is not oppositional to this restoration plan. Project banks along the south project margin adjacent to the agricultural fields will use the most robust wood toe installations with the intent of establish the current boundary as the limit of the channel corridor while driving corridor expansion to the Northern boundary. Bank full benches are 10 feet minimum width and set at the bankfull (1.5 YR recurrence interval event) plus 0.5 feet. The 0.5 foot surcharge allows for settlement and it is typical for banks on outside bends to be slightly higher than the opposite point bar elevations. These surfaces, where they exist naturally on Brackett Creek, colonize with herbaceous wetland species and riparian shrubs, which provide maximum channel margin stability. A third feature at each project bank is creation of an expanded riparian zone in the most active migration pathways on the North corridor boundary and at several sites on the interior of the channel corridor. Created floodplains are excavated to an elevation equal to the bankfull water surface plus 1.5 feet. This elevation was modeled and found to correlate well to the delineated wetland boundary and it has favorable hydrology to establish and maintain riparian shrubs. Both the bankfull bench and floodplain benches are intended to create a meaningfully wide migration buffer where riparian plants can be established and maintained. Excavations also lower bank heights, which will reduce the gravitational erosional forces. Proposed no-excavation riparian revegetation sites are also proposed. These areas were identified through a hydraulic modeling effort and were found to be within the bankfull plus 1.5' elevation ranch. Modeled areas that were selected as revegetation sites occurred within a meander migration pathway. The ranch access bridge at Station 33+65 is to be removed. The integrity of the bridge has not been determined but effort will be made to remove the bridge in one piece to minimize debris falling into the creek. If the bridge integrity is determined by the contractor to be suitable it can remain in place to allow equipment access on the North side of the creek. If it cannot carry construction loads it will be removed and a temporary wet construction access will be established for work on the North side.

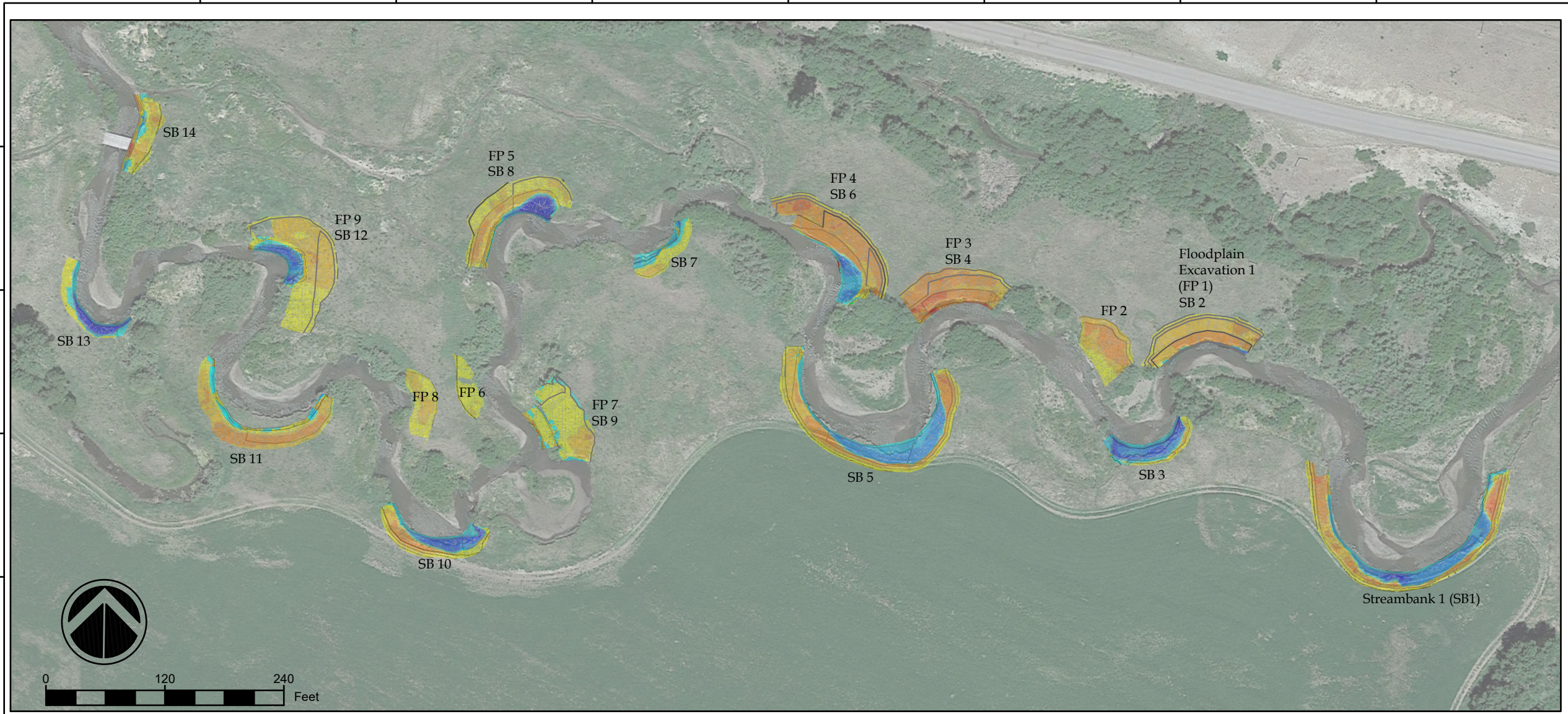
TREATMENT AREAS AND LENGTHS						
PROJECT AREA	TOTAL LENGTH FEET	BANKFULL BENCH AREA FT ²	FLOODPLAIN EXCAVATIONS FT ²	BANK TYPE I FEET	BANK TYPE II FEET	BANK TYPE III FEET
SB1	305	6755	0	110	160	35
SB2 - FP1	95	1810	1970	50	0	50
SB3	90	2180	0	0	90	0
FP2	0	0	2200	0	0	0
SB4 - FP3	85	1570	2200	40	0	45
SB5	260	6950	0	100	130	30
SB6 - FP4	105	2310	3510	45	60	0
SB7	70	1540	0	0	0	70
SB8 - FP5	105	2645	1780	55	50	0
FP6	0	0	1110	0	0	0
SB9 - FP7	45	730	2843	45	0	0
SB10	105	2790	0	35	70	0
FP8	0	0	1685	0	0	0
SB11	180	4130	0	180	0	0
SB12 - FP9	70	1170	5060	65	0	0
SB13	105	1710	0	50	55	0
SB14	100	1790	0	55	0	45
TOTALS	1,720	38,080	22,360	830	615	275



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EARTHWORK QUANTITIES
BRACKETT CREEK RESTORATION
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Notes:
 In general, yellow to red shades indicate locations where Type I or Type III Treatments will be installed and blue shades indicate areas where Type II treatments will be installed. Material balances vary from bank to bank. A soil disposal site will be determined prior to construction but will be in the vicinity of the project but outside of the 100-YR floodplain. To the extent possible, sod should be salvage during excavation and used as surface cover on finished surfaces. Excavation end treatments are not shown in detail on these plans. End treatments should blend smoothly into up and downstream surfaces that are generally lower in elevation and more densely vegetated.

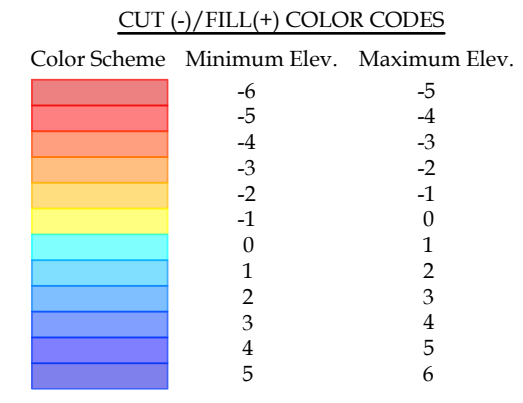
Bank composition varies with location. The photo shows a typical bank profile.



Upper Bank - 1.5' to 2' Fine Soils
 To disposal or backfill of outer 5' of bank installation

Lower Bank - 2' to 4' of Alluvium
 Suitable for wood toe backfill

EARTHWORK MATERIAL QUANTITIES			
PROJECT AREA	EXCAVATION*	FILL**	EXCAVATION TO FINISHED GRADE
	YD ³	YD ³	YD ³
SB1	385	195	225
SB2 - FP1	170	40	205
SB3	15	105	15
FP2	140	0	140
SB4 - FP3	385	30	325
SB5	365	220	220
SB6 - FP4	425	60	360
SB7	20	10	20
SB8 - FP5	220	100	140
FP6	20	0	20
SB9 - FP7	150	40	85
SB10	130	75	70
FP8	50	0	50
SB11	475	135	215
SB12 - FP9	275	85	180
SB13	85	90	10
SB14	140	40	60
TOTALS	3,450	1,225	



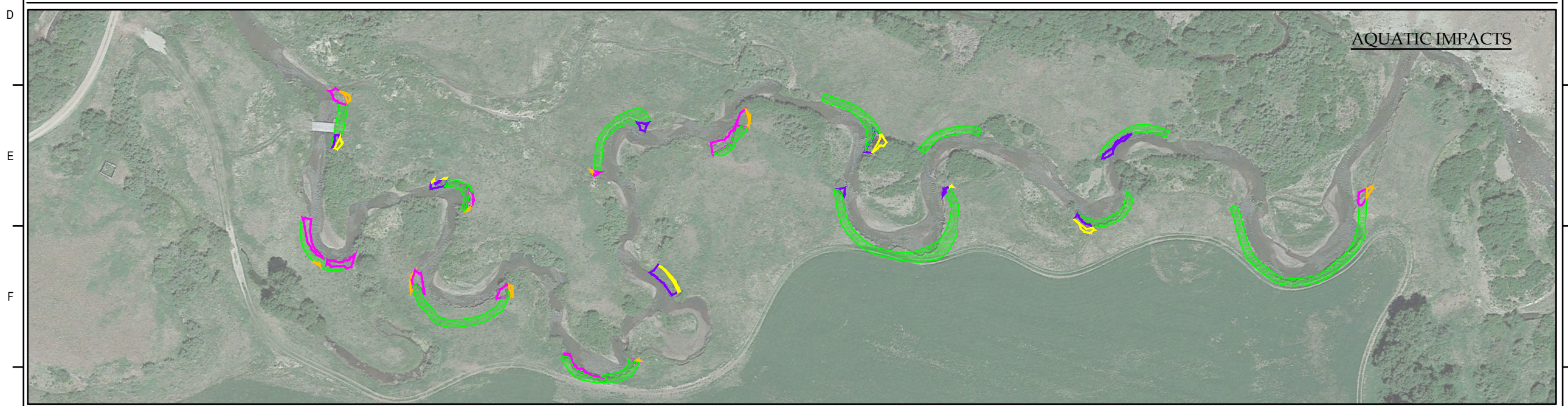
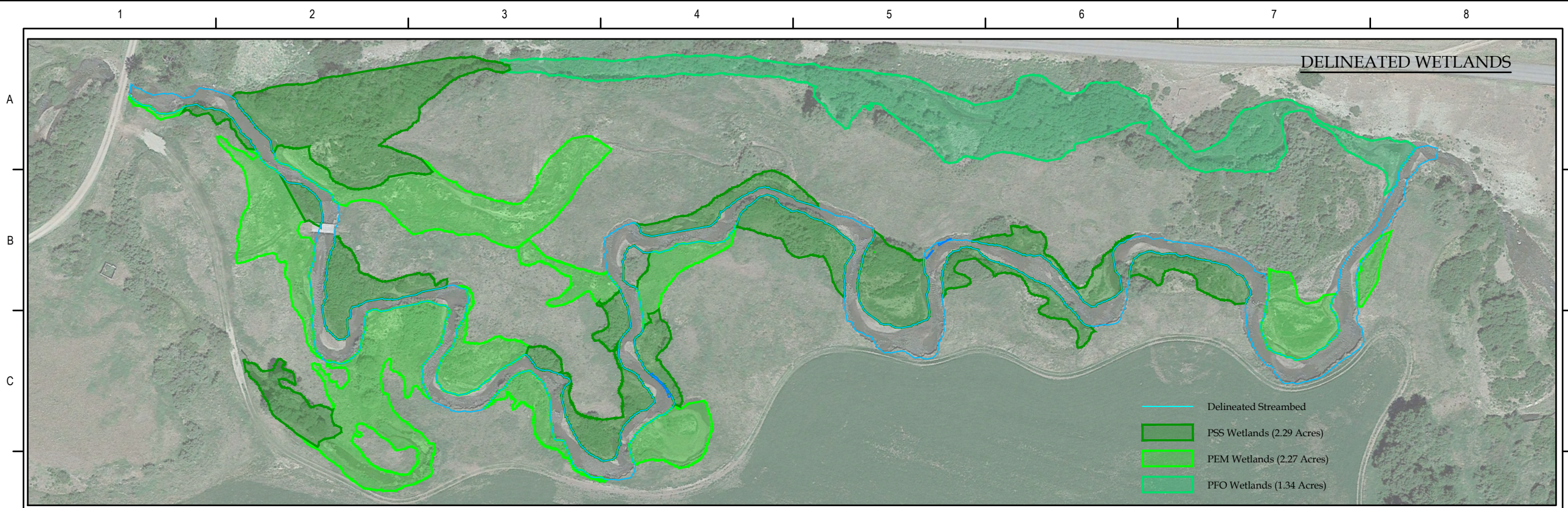
*Total excavation includes excavation to the finished grade lines plus sub-excavation of the wood toe envelope and pool excavation (Sheet 12). An excavation to finished grade is provided in column 4 to provide a relative level of effort for each component.

**Total fill includes in channel fills to the finished grade lines where Type II installations are specified plus backfill of the wood toe envelope for Type I and Type II treatments. An assumption that approximately 50% of the wood toe backfill is alluvium and 50% is woody materials.

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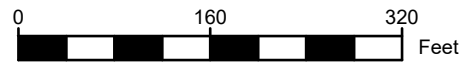
PROJECT NO: 0323-2
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 PROJECT NO: DATE: 01/31/24
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WETLAND DELINEATION AND AQUATIC IMPACTS
BRACKETT CREEK RESTORATION
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Notes:
 Areas where wetlands will be filled generally occur at up and downstream tie in points where bank treatments tie into a lower floodplain surface. These areas are expected to convert back to wetland status after the project is completed. The upland excavation areas that are expected to convert to wetland status with a high degree of confidence correspond to the created bankfull benches. Excavated floodplain benches are on average one foot higher in elevation than the bankfull benches and they were not included in these calculations although portions of these will likely convert to wetland.

Fills Below OHWM	
Area (Acres)	Volume (Yd ³)
0.301	1920

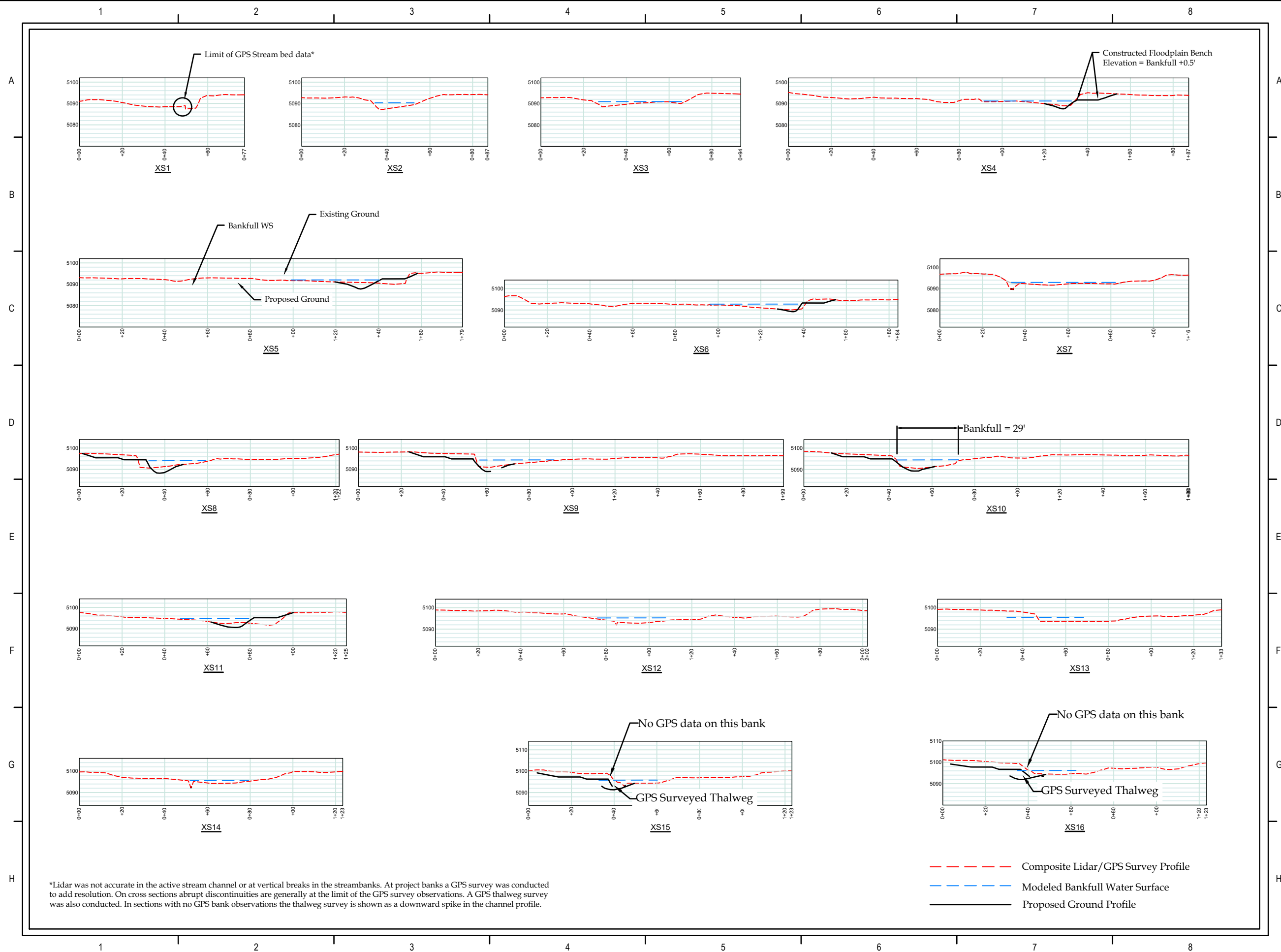


Aquatic Resource Impacts					
Impact Type	Permanent Impact	Permanent Impact	Creation /	Fill/Excavation	
	Fill	Excavation	Conversion	Volume	
	Acres	Acres	Acres	YD ³	
PEM - FILL	0.057		0.057	180	
PEM - Excavation		0.006	0.006	0	
PSS - Fill	0.045		0.045	75	
PSS - Excavation		0.010	0.010	0	
Terrace Excavation (Uplands)	0	0	0.348	0	
TOTALS	0.102	0.016	0.466	255	

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CROSS SECTIONS 1 - 16
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*Lidar was not accurate in the active stream channel or at vertical breaks in the streambanks. At project banks a GPS survey was conducted to add resolution. On cross sections abrupt discontinuities are generally at the limit of the GPS survey observations. A GPS thalweg survey was also conducted. In sections with no GPS bank observations the thalweg survey is shown as a downward spike in the channel profile.

--- Composite Lidar/GPS Survey Profile
 --- Modeled Bankfull Water Surface
 — Proposed Ground Profile

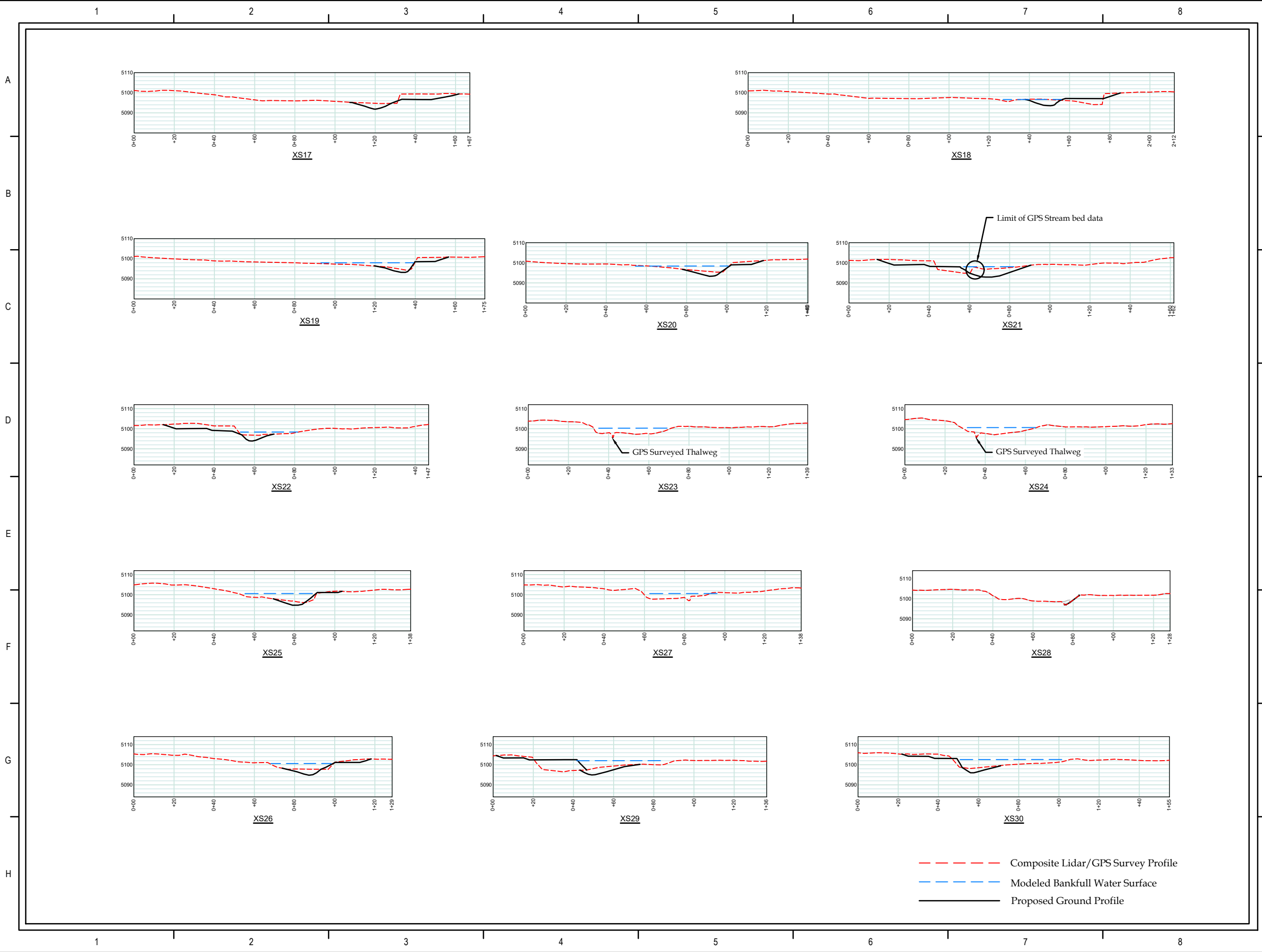
NO.	DATE	DESCRIPTION

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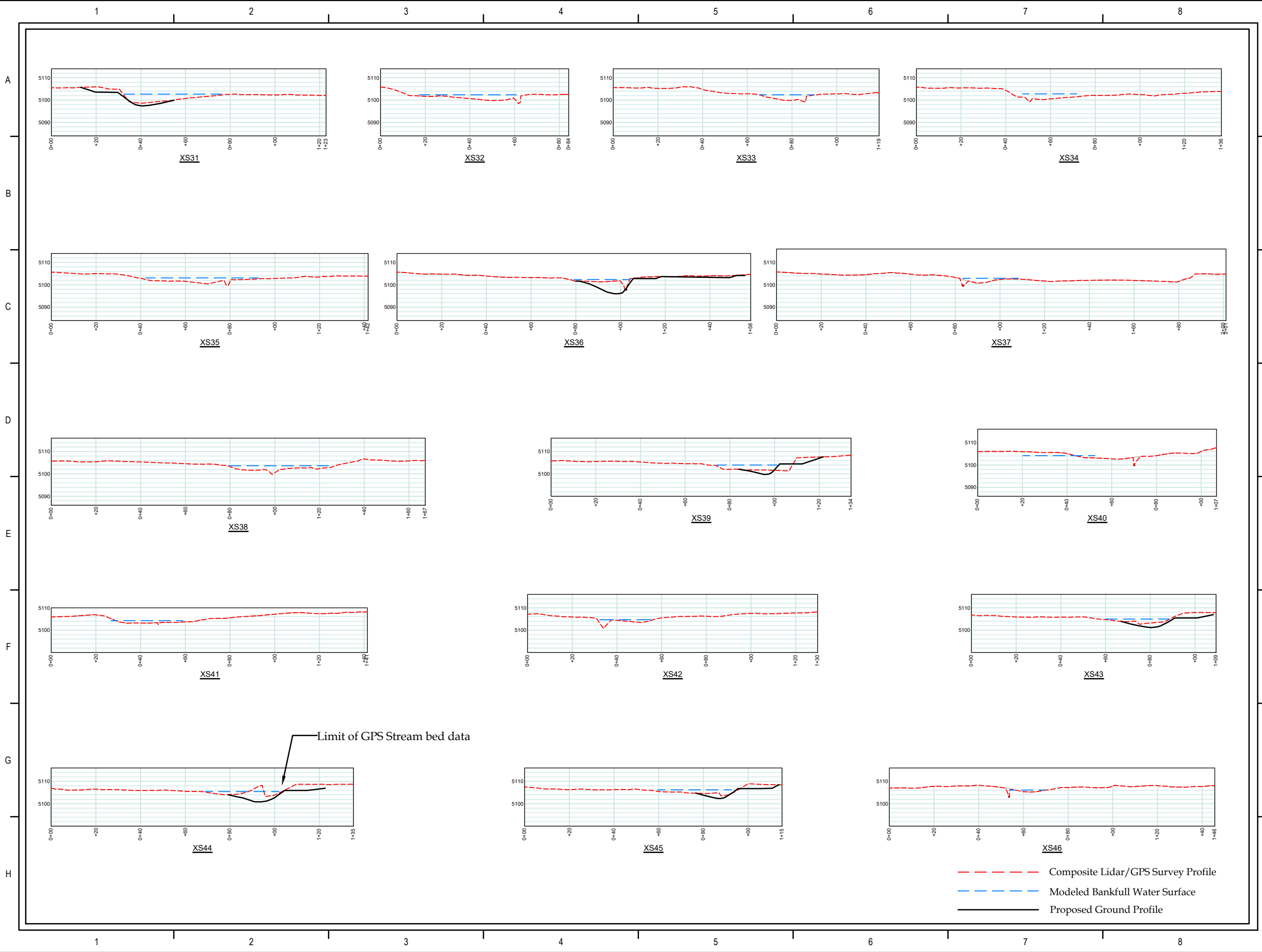
CROSS SECTIONS 17 - 36
BRACKETT CREEK RESTORATION
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CROSS SECTIONS 31 - 46
BRACKETT CREEK RESTORATION
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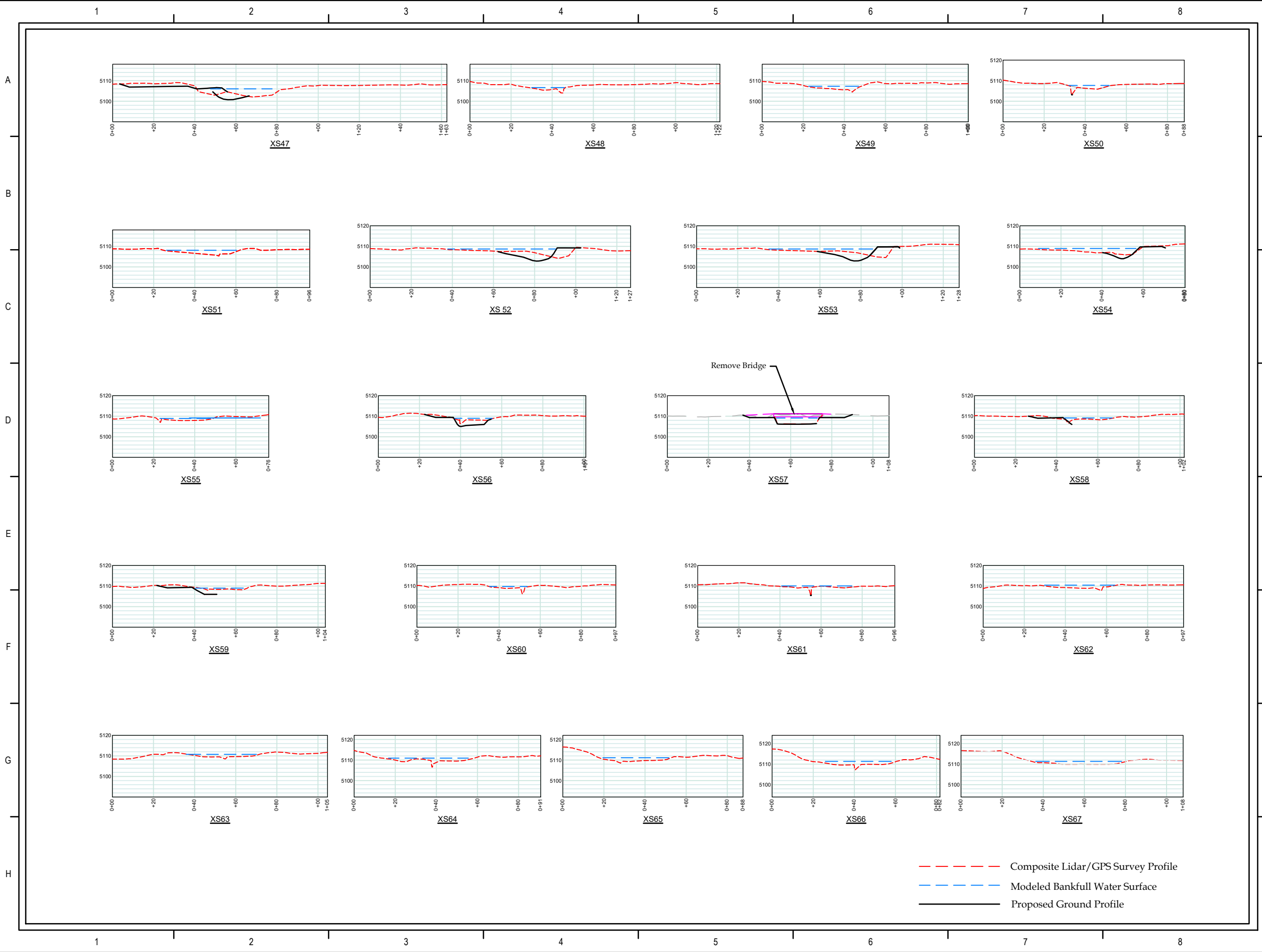
PROJECT NO.:
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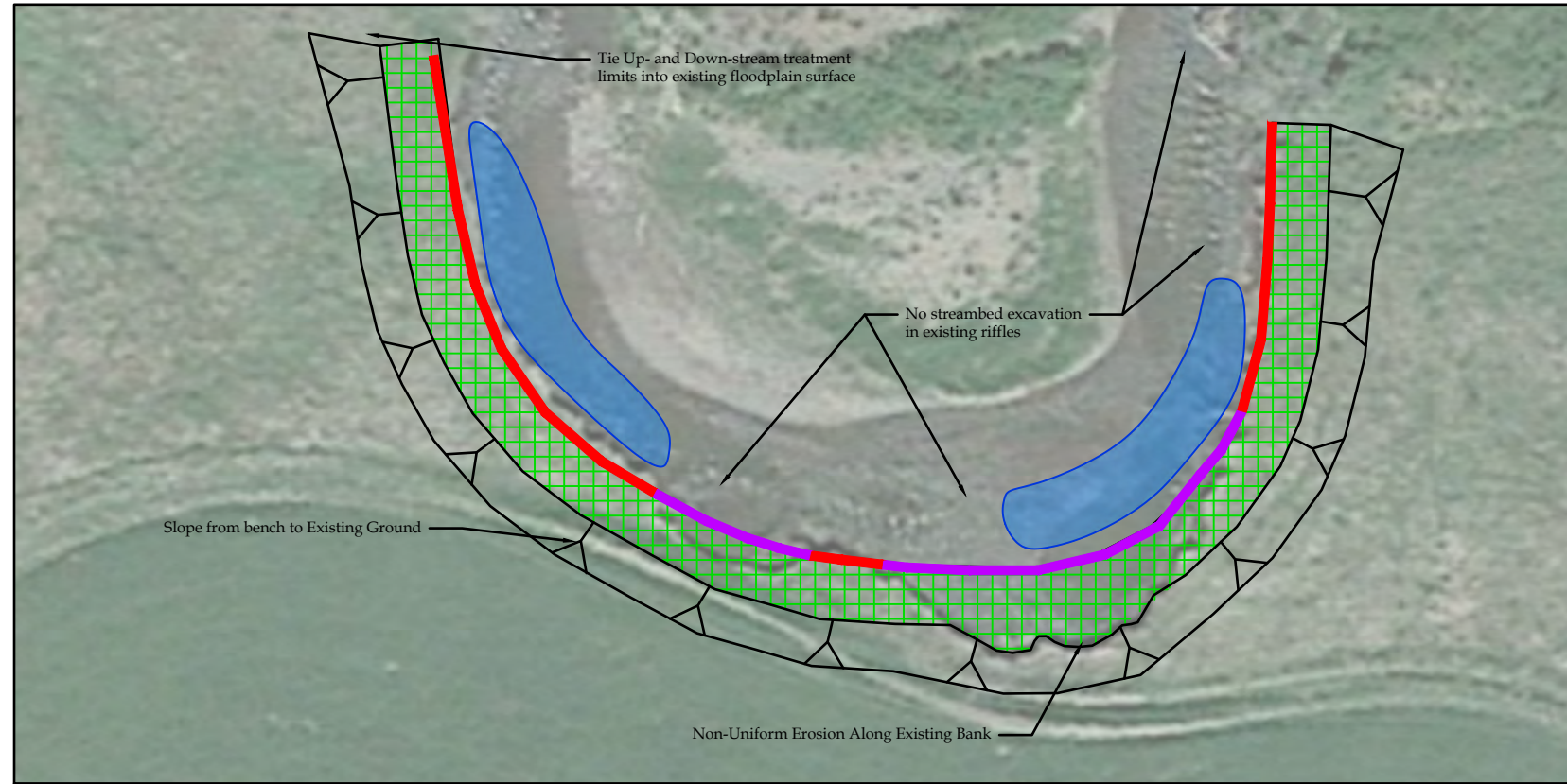
CROSS SECTIONS 47 - 67
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STREAMBANK RESTORATION - TYPICAL PLAN VIEW



General Notes:

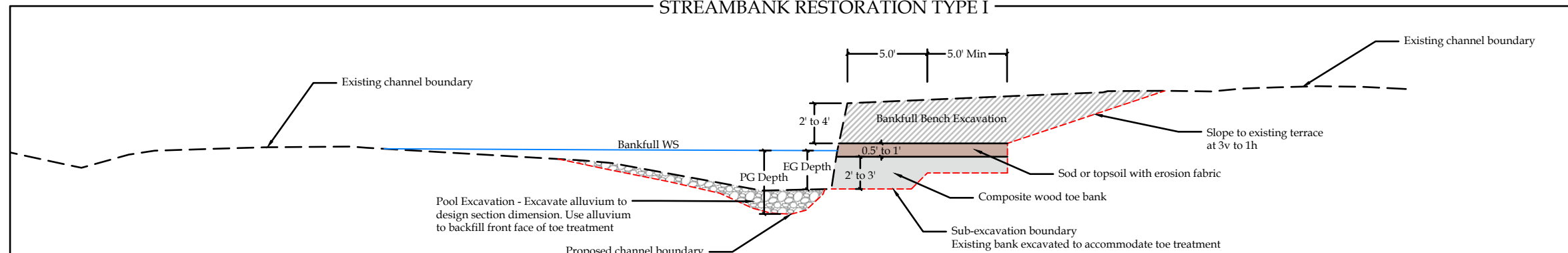
Lateral bank erosion into terrace surfaces occurs throughout the project reach. A composite wood toe treatment in conjunction with a constructed bankfull bench is proposed to create a stable bank margin. Near term stability is provided by a matrix of live and dead wood stems backfilled and compacted with native alluvium. Over time as wood materials degrade, long term stability will transition to be governed by mature native vegetation. The bankfull bench serves multiple purposes. It provides favorable hydrology for establishing riparian vegetation, it expands the flood prone area and it reduces bank height, reducing bank loss due to gravitational collapse.

Though the reach, the channel width is appropriate for a C4 Type Channel in some reaches and it is over-widened in others. Where appropriate channel dimensions occur adjacent to terrace erosion the existing terrace will be excavated to accommodate the composite wood toe treatment and bankfull bench (Treatment Type I). Where the channel is over-widened adjacent to an eroding terrace the wood toe treatment will be constructed in the active channel to narrow the channel section (Treatment Type II).

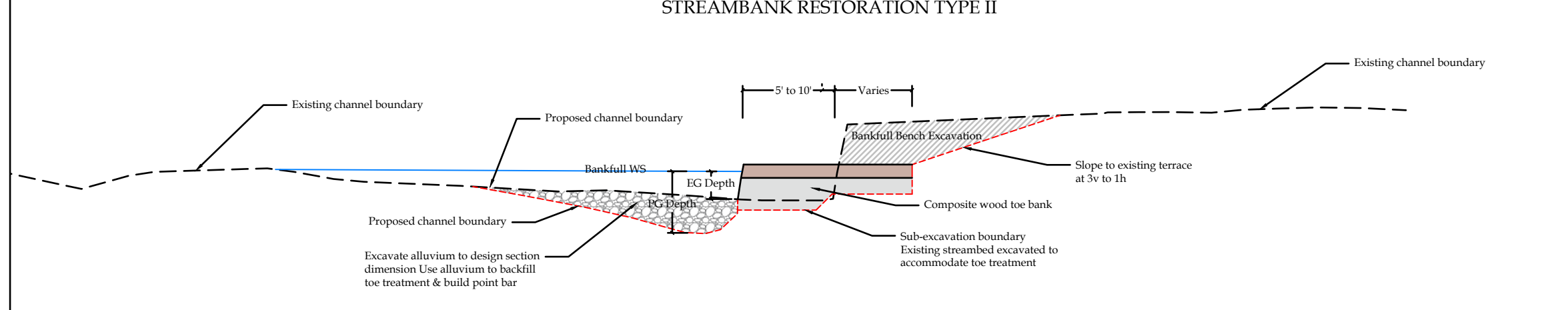
- STREAMBANK RESTORATION TREATMENT TYPE I
- STREAMBANK RESTORATION TREATMENT TYPE II AT OVER-WIDENED CROSS SECTIONS
- BANKFULL + 0.5' BENCH
- POOL EXCAVATION



STREAMBANK RESTORATION TYPE I



STREAMBANK RESTORATION TYPE II

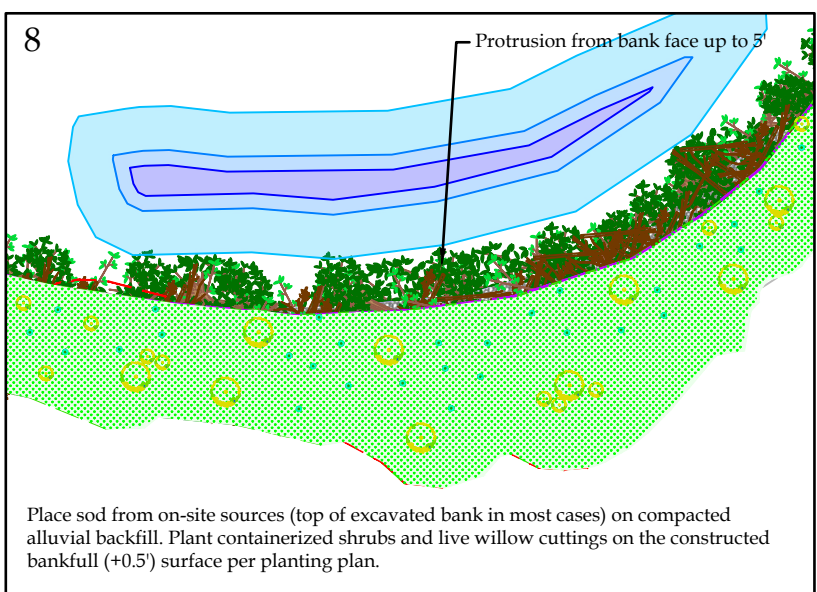
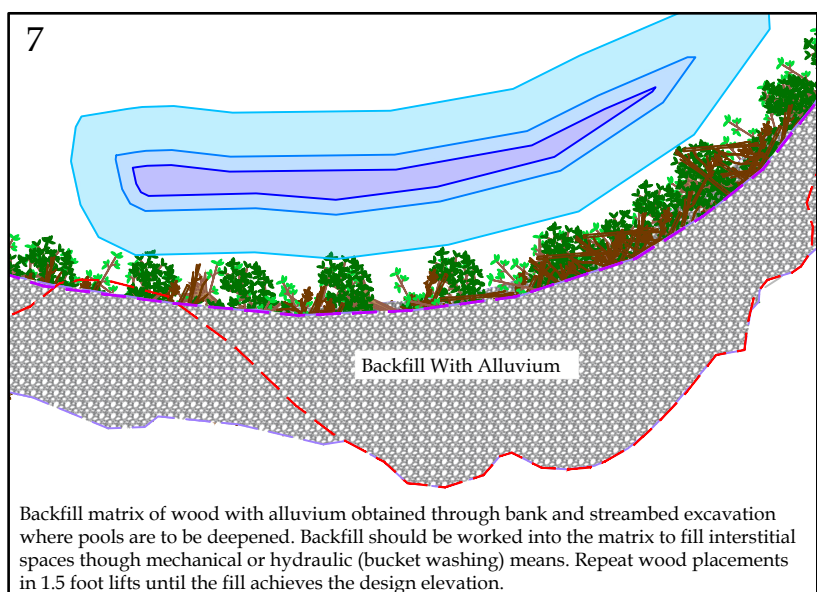
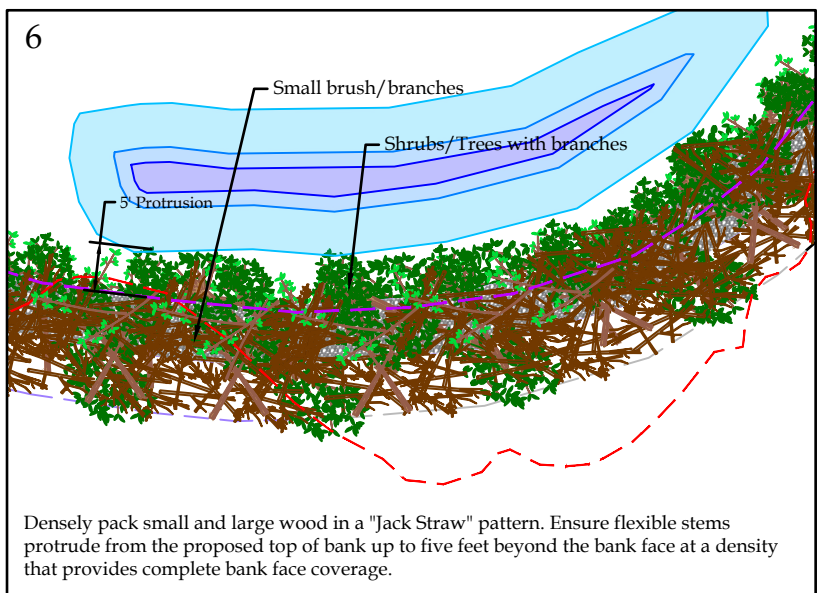
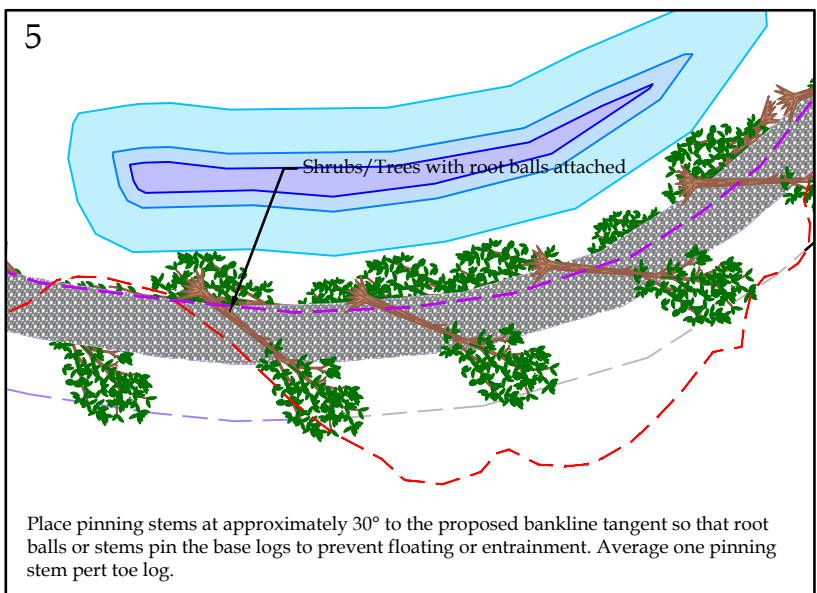
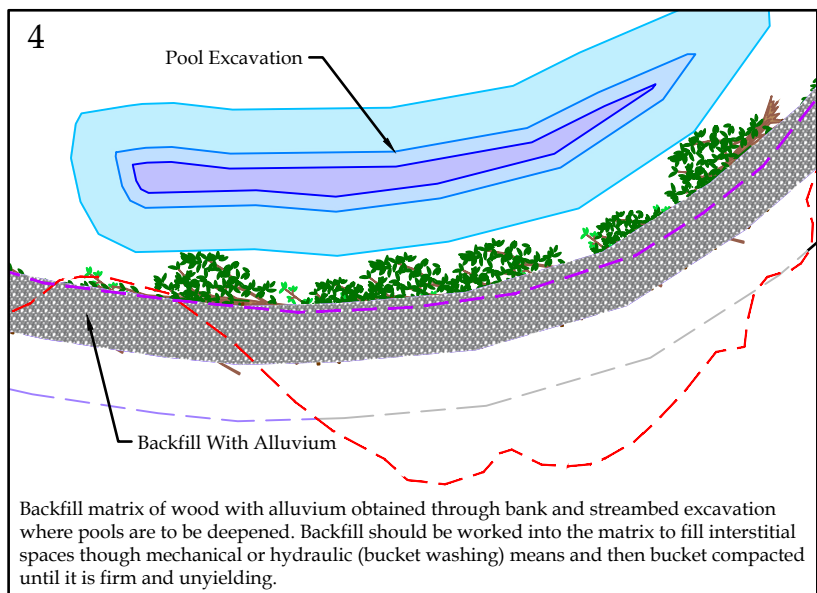
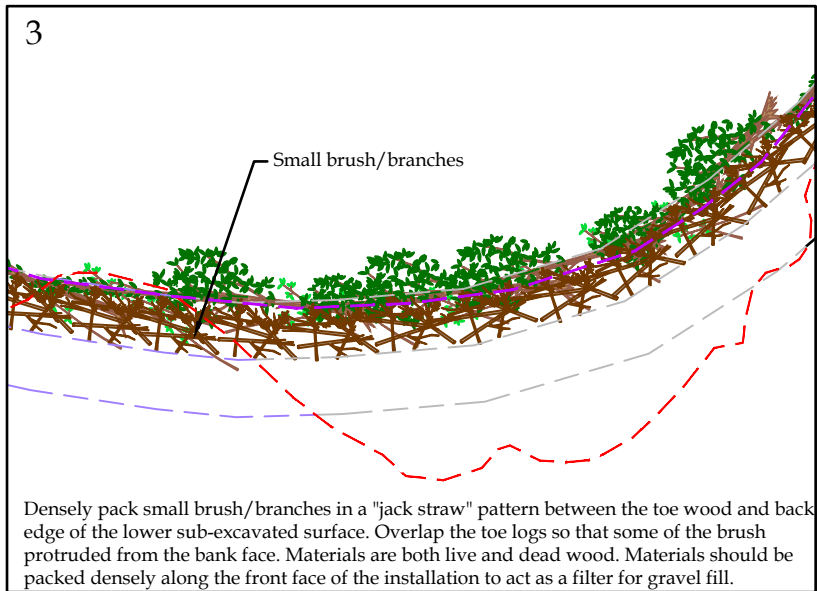
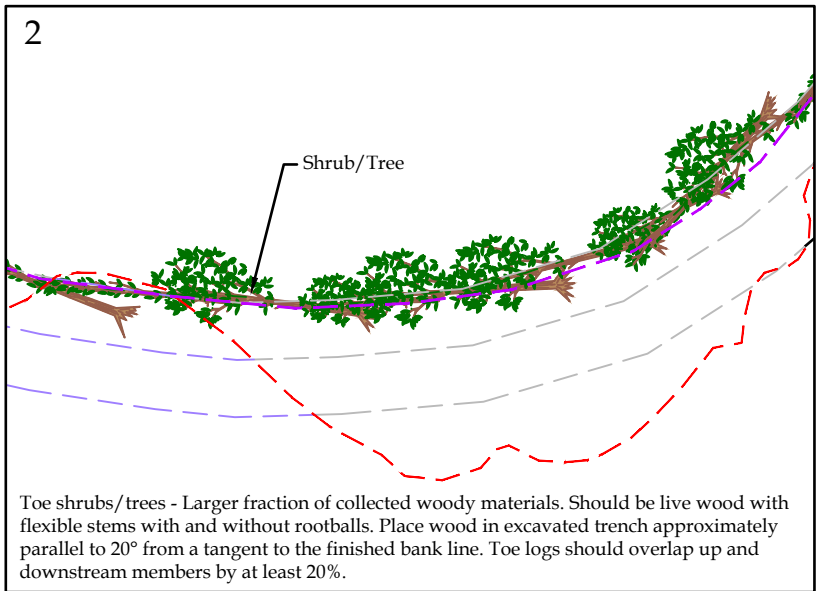
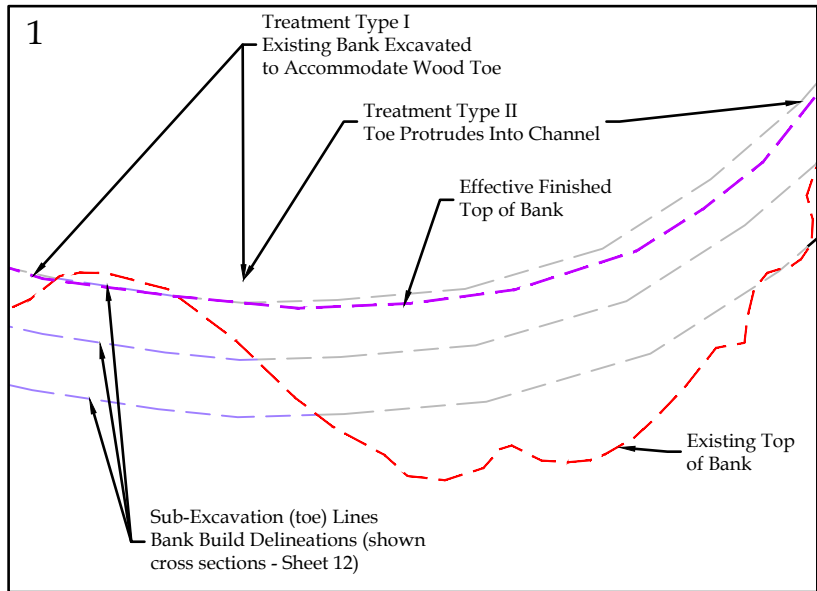


BANK RESTORATION SCENARIOS
 BRACKETT CREEK RESTORATION
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COMPOSITE WOOD TOE CONSTRUCTION SEQUENCE



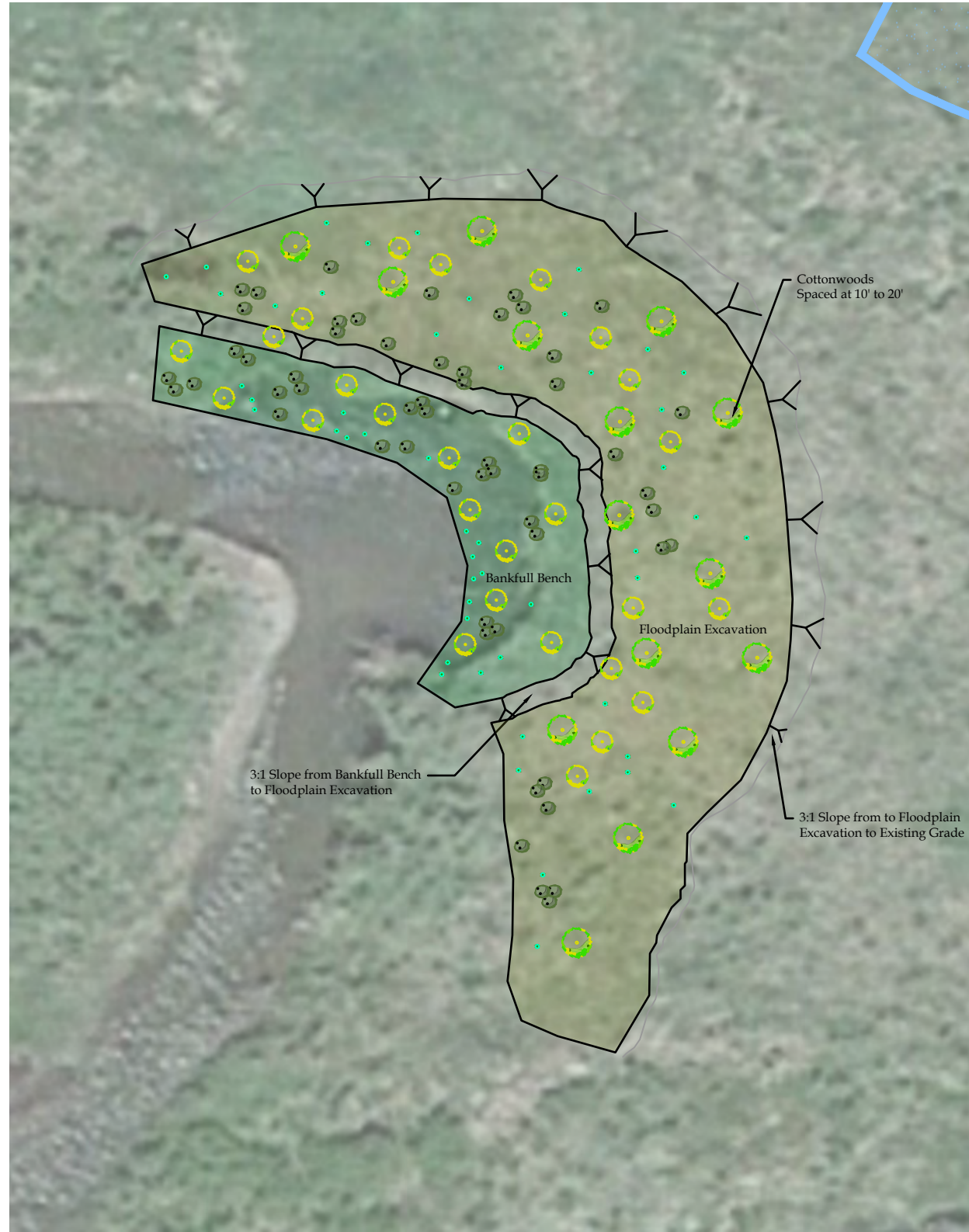
- Shrub/Tree with rootball and flexible branches (10' to 15')
- Shrub/Tree with flexible branches and without rootballs (10' to 15')
- Brush/Branches - Live and dead wood (4' - 10' length)
- Live Willow Cuttings (6' - 10' length)
- Live Willow Cuttings (planview) (6' - 10' length)
- Tree & Shrub Plantings

COMPOSITE WOOD TOE TREATMENT
DETAIL - PLAN VIEW
BRACKETT CREEK RESTORATION
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TYPICAL REVEGETATION SCHEME



Notes:

1. Riparian Shrubs, willow cuttings and alder planted on the Bankfull Surface
2. Riparian Shrubs, Alder, willow cuttings and cottonwood planted on constructed floodplain surfaces.
3. Willow cuttings integrated into wood toe treatments.
4. Alder are an important species on this reach of Brackett Creek for stabilizing banks and driving habitat formation
5. Riparian shrubs include native willow species and dogwood

-  Willow Cuttings (5/lineal ft of wood toe construction)
-  Containerized Alder (75 per acre)
-  Containerized Riparian Shrubs (150 per acre)
-  Containerized Cottonwoods (50 per acre)

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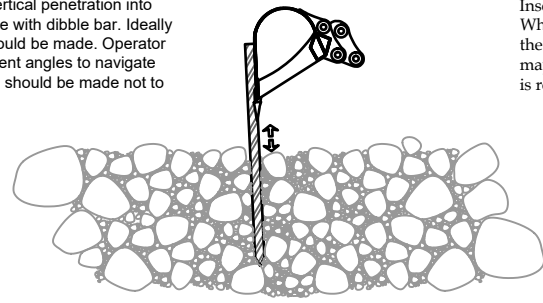
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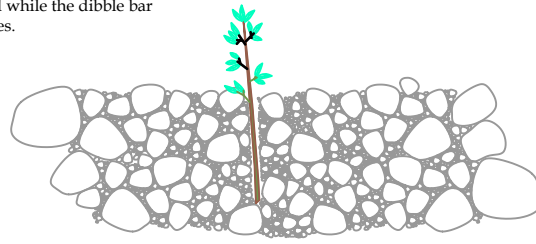
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PROPOSED WILLOW CUTTING PLANTING METHOD

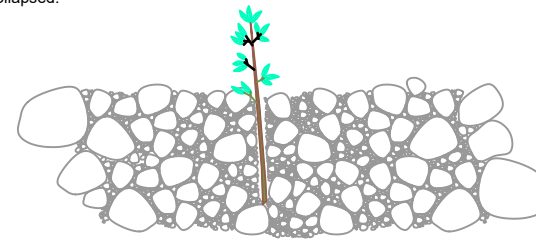
Make vertical to near vertical penetration into cobble/boulder substrate with dibble bar. Ideally a 4' foot penetration should be made. Operator may have to work different angles to navigate larger particles but care should be made not to create too large a hole.



Insert live willow cutting into prepared hole. Where a high percentage of sand is present the hole may partially close. Willow cutting may have to be inserted while the dibble bar is removed in these cases.

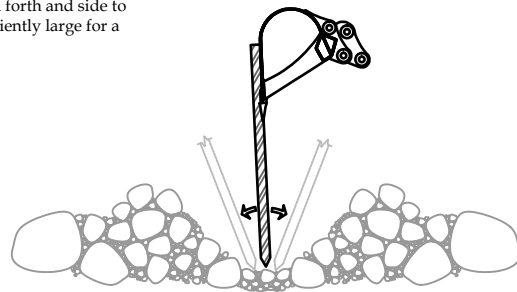


Use hand tools to collapse the hole around the cutting. Add additional sand to hole as needed to eliminate air gaps or water in the cutting until all air gaps are collapsed.

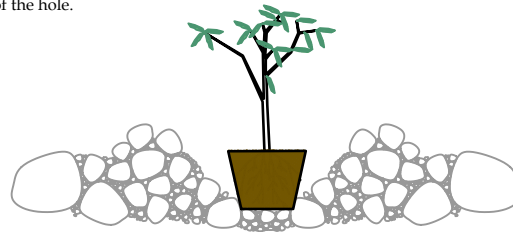


ADDITIONAL USE OF DIBBLE BAR IN GRAVEL SUBSTRATES

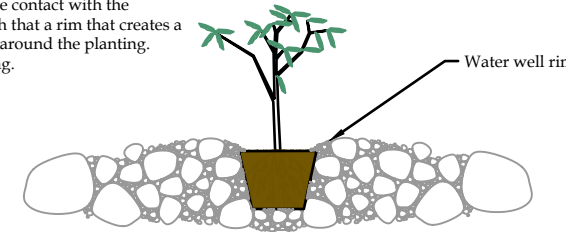
Work dibble bar back and forth and side to side to create a hole sufficiently large for a containerized planting.



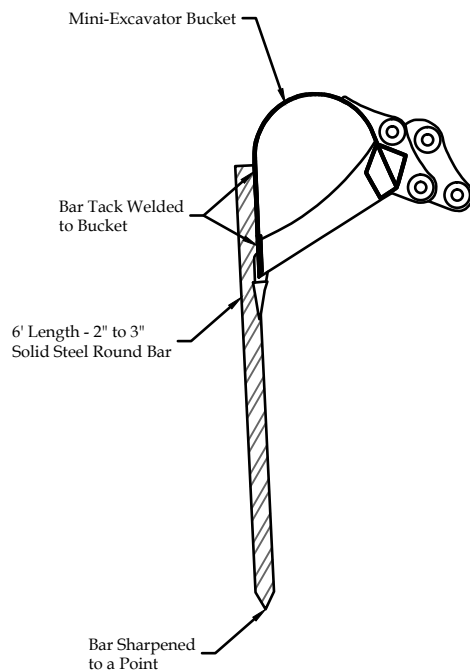
Remove tree from container and place in prepared hole. Make sure that the bottom of the planting makes good contact with the earth at the bottom of the hole.



Use hand tools to fill materials around the planting root ball. Avoid backfilling with larger materials and use as much sand and silt as is available to make contact with the planting. Backfill such that a rim that creates a water well is formed around the planting. Water in each planting.



PROPOSED PLANTING DIBBLE BAR SET-UP



Vegetation Restoration: Establishment of riparian woody vegetation is a critical component of this project. Vegetation will be established through installation of live willow cuttings and planting of containerized trees & shrubs. Revegetation may occur over several years with subsequent year plantings being informed by success / failure of initial plantings.

Materials will be live cuttings or restoration quality 1 to 2 gallon containerized materials.

Containerized Tree & Shrubs Planting: Plantings will occur in generally in gravel alluvium and fine soils. Dig a hole 2 to 3 times larger than the container diameter. Gently remove plants from containers before placing in the ground and firmly pack soil around roots, water and "mud-in" to eliminate air pockets. Before planting, loosen any spiraling or compacted roots.

Tree & Shrub Protection: Permanent browse protection is not practical in regularly flooded zones but may be needed seasonally. Protection should be maintained until terminal buds are above deer browse height. Simple browse protection in the form of 4" wire mesh secured with T-Posts or an equivalent may be installed at the time of tree and shrub planting. Planting group protection may also be used provided it is of sufficient height to prevent

deer from leaping over the protection.

Live Cutting Specification: Live willow cuttings will be used throughout the proposed treatments.

Basal diameter of willow cuttings should be between 1/2 - 3 inches in diameter and 3 - 5 feet in length. Generally, larger diameter cuttings are better as they ensure a large supply of stored energy in the stem, which improves establishment success and they are more durable while inundated. Also, longer cuttings usually experience greater rooting success than shorter cuttings.

Choose healthy stems (i.e., "green" wood in cross section) that are: relatively straight, covered in smooth bark (i.e., not furrowed or damaged), and free of insect / pathogen damage.

Ethical harvest guidelines should be followed to conserve health of the donor stand:

1. No more than 1/3rd of the branches from any single willow will be harvested.
2. No more than 40% of the overall willow canopy cover will be removed.
3. Stems should be harvested evenly through the stand (e.g., not from one side of the willow only).

Harvest and Installation:

1. Cuttings should be harvested during dormancy.
2. All side branches should be trimmed so cutting is a single stem for the revegetation cuttings.
3. Stem ends should be trimmed so that the small end of the cutting is approximately 0.5" in diameter or greater.
4. All cuttings should be completely submerged and soaked for no less than 10 days before installation.
5. Cuttings should be kept cool and moist during the planting operation.
6. The terminal 2 to 3 inches of a cutting may be painted with a 50% mix of light latex paint and water so that cutting ends are more easily identified during installation.
7. At least two buds and/or bud scars should be above the ground after planting for revegetation cuttings.
8. If the top of the stakes are damaged (split) for any reason they should be pruned down to an undamaged area on the stake or replaced.
9. After installation cuttings should be trimmed so that no more than 1/4 of the total cutting length is protruding from the ground.



PLANTING DETAILS
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PROJECT LENGTHS/DIMENSIONS		
DESCRIPTION	QUANTITY	UNITS
Type I Bank Construction	830	LF
Type II Bank Construction	615	LF
Type III Bank Construction	275	LF

EXCAVATIONS / REMOVALS			
DESCRIPTION	QUANTITY	UNITS	SOURCE/ DESTINATION
Bulk Excavation* (In-place Volume)	3,450	YD ³	Channel Banks and Floodplain Excavations
Soil Disposal (Compacted Volume)	2,205	YD ³	To Disposal Site (Sheet 2)
Bridge Removal	1	UNITS	TBD
MATERIAL QUANTITIES/FILLS			
DESCRIPTION	QUANTITY	UNITS	SOURCE/ DESTINATION
Native Sod	320	YD ³	On-Site Excavations
Alluvial Fill	925	YD ³	On-Site Excavations
North American Green C125BN Erosion Fabric	20	Rolls (6.67' X 108')	Erosion Products Supplier
Erosion Fabric Staples	4,000	UNITS	Erosion Products Supplier
Wood Material Collections	7,800	STEMS	On-Site Collections
Live Willow Collection	7,800	STEMS	On-Site Collections
Containerized Alder (2.43 Acres)	180	STEMS	Native Plant Nursery
Containerized Cottonwoods (2.43 Acres)	120	STEMS	Native Plant Nursery
Containerized Shrub Plantings (2.43 Acres)	365	STEMS	Native Plant Nursery
Wet Riparian Seed Mix	40.00	LBS	Native Seed Supplier

*Bulk Excavations includes approximately 2,340 yd³ to finished grade, 910 yd³ bank toe sub-excavation and 200 yd³ of pool excavations.

Containerized Tree & Shrub Species List
Species
Alder (<i>Alnus incana</i>)
Narrowleaf Cottonwood (<i>Populus angustifolia</i>)
Red Osier Dogwood (<i>Cornus sericea</i>)
Bebb Willow (<i>Salix bebbiana</i>)

Sizes vary depending on availability

Riparian Seed Mix
Species
Baltic Rush (<i>Juncus balticus</i>)
Bluejoint Reedgrass (<i>Calamagrostis canadensis</i>)
Tufted Hair Grass (<i>Deschampsia cepitosa</i>)
Blue Wildrye (<i>Elymus glaucus</i>)
Nebraska Sedge (<i>Carex nebrascensis</i>)
Mountain Bromegrass (<i>Bromus marginatus</i>)
Slender Wheatgrass (<i>Elymus trachycaulus</i>)
Western Wheatgrass (<i>Pascopyrum smithii</i>)
Beaked Sedge (<i>Carex rostrata</i>)
Western Yarrow (<i>Achillea millefolium</i>)

MATERIAL QUANTITIES
BRACKETT CREEK RESTORATION
AVIS PROPERTY

NO.	DATE	DESCRIPTION

PROJECT NO: 0323-2
 DESIGNED: TC DRAWN: TC CHECKED: TC
 PROJECT NO: DATE: 01/31/24
 SHEET NO: 16

1 2 3 4 5 6 7 8

A



B

C

A

B

C



D



E

F



G

H

D

E

F

G

H

PHOTOS
BRACKETT CREEK RESTORATION
AVIS PROPERTY

NO.	DATE	DESCRIPTION

PROJECT NO: 0323-2
 DESIGNED: TC DRAWN: TC CHECKED: TC
 PROJECT NO.:
 DATE: 05/10/23
 SHEET NO.: 17

1 2 3 4 5 6 7 8



Natural revegetation on depositional surface

Example of a "reference" bank with low bank height ratio and colonization with sedge

Example of a "reference" bank with low bank height ratio and colonization with sedge

PHOTOS
BRACKETT CREEK RESTORATION
AVIS PROPERTY

NO.	DATE	DESCRIPTION

PROJECT NO: 0323-2
 DESIGNED: TC DRAWN: TC CHECKED: TC
 PROJECT NO: DATE: 05/10/23
 SHEET NO: 18



Stabilizing effect of a single shrub

Typical project bank profile



PHOTOS
 BRACKETT CREEK RESTORATION
 AVIS PROPERTY

NO.	DATE	DESCRIPTION

PROJECT NO: 0323-2
 DESIGNED: TC DRAWN: TC CHECKED: TC
 PROJECT NO.:
 DATE: 01/31/24
 SHEET NO.: 19



Typical project bank profile.



PHOTOS
BRACKETT CREEK RESTORATION
AVIS PROPERTY

NO.	DATE	DESCRIPTION

PROJECT NO: 0323-2
 DESIGNED: TC DRAWN: TC CHECKED: TC
 PROJECT NO.:
 DATE: 01/31/24
 SHEET NO.: 20



Canyon Creek Restoration and Monitoring

505 Ventures Ranch Trout Unlimited

Canyon Creek is a tributary of the Shields River outside of Bozeman, Montana, at the northern-most range of Yellowstone cutthroat trout (YCT). Through historic land use practices, an abandoned cement dam, and beaver removal, natural stream function has been disrupted and YCT habitat has been degraded. Trout Unlimited, USGS, and Montana Fish, Wildlife & Parks, are proposing to restore stream function and YCT habitat through removing the dam and using low-tech process-based restoration (LTPBR) techniques to aggrade the channel and reconnect the floodplain, restore a valley-wide riparian zone, and increase habitat diversity for YCT. This project has been selected for intensive monitoring to identify the effectiveness of LTPBR techniques and the fish response to the restoration and improve our understanding of potential management solutions and strategies to enhance YCT populations and riverscape health.

Canyon Creek is a tributary of the Shields River with its headwaters at approximately 7,000 ft elevation in the Custer Gallatin National Forest outside Bozeman, Montana. This stream provides habitat to native Yellowstone cutthroat trout, and an existing water lease on the creek ensures that it provides cold water to the Shields River during hot summer months—thus providing important refugia during warm, dry years. The upper portion of Canyon Creek runs for 8 miles through the 505 Ventures Ranch, with an additional 3.74 miles on adjacent State or US Forest Service land. This one-mile project location was identified as highest restoration priority on Canyon Creek through the 505 Ventures Ranch, but opportunities for habitat enhancement and floodplain reconnection exist throughout the ranch and on adjacent public land and downstream private land. This project represents an important opportunity to build collaborative relationships between state, federal, and private landowners, and will serve as a springboard for similar conservation opportunities for Yellowstone cutthroat trout.

The major impairments to Canyon Creek at this location are primarily due to an old cement dam with two small, plugged culverts associated with an historic homestead. Fish passage is impeded as the structure contains two metal culverts, one of which has been blocked with sediment for years and is buried on its upstream end, while the other has more recently been blocked by beavers, despite clearing efforts. Due to the sediment settling out above the dam and the firehose effect created by the small culvert diameter (Figure 1a) erosion rates are elevated directly downstream of the dam, causing the stream to incise for nearly 1 mile downstream, limiting floodplain connectivity, riparian vegetation, channel complexity, and adding fine sediment to the sediment-impaired Shields River. Additionally, the recent beaver activity blocking the remaining culvert is forcing the stream to find a new path. The stream is beginning to migrate to the left (north) of the channel, spilling over a low spot in the cement dam and cutting a new channel through grass and fine sediment (Figure 1b). With little deep-rooted vegetation in this immediate area, this will lead to further channel instability and erosion.

In addition to the above-mentioned dam, historic land use practices and beaver trapping/removal have contributed to channel degradation. While the stream and associated riparian vegetation likely historically occupied the entire valley bottom – and still do in places, riparian vegetation is limited to a thin strip along the streambanks in a large portion of this reach, where shallow-rooted grasses are the primary vegetation beyond the riparian strip. Despite the channel incision, beaver activity in the last 10-15 years

has kept parts of the floodplain active, and although incised, the section of stream immediately below the dam has a healthy and wide riparian area (Figure 2). This existing woody vegetation can provide important structural elements for beaver activities that will reconnect the active channel to this floodplain and promote greater water storage and diverse instream habitats for YCT.



A. B.
Figure 1. A) Looking upstream at the dam in 2022 before beavers blocked the second culvert. Erosion underneath the cement structure is evident. B) In 2023 beavers blocked the culvert and the stream began forming a new channel to the north of the existing channel and culvert.



Figure 2. Google Earth imagery from 2021 showing a wide riparian zone directly below the dam, and a narrow riparian zone further downstream.



In addition to the stream restoration, Trout Unlimited (TU) has been working with the USGS, USFS, and Montana Fish, Wildlife & Parks (FWP) to identify upcoming LTPBR restoration projects for intensive monitoring to increase our knowledge of the effectiveness of different restoration approaches across the landscape. The Canyon Creek restoration project has been identified as a high priority project for collaborative implementation of intensive stream restoration monitoring. The relative ease with which LTPBR projects can be conducted makes it possible to rapidly and cost effectively implement many projects across a watershed, but their effectiveness is often unclear (Roni et al. 2019; Bilby et al. 2023). This research aims to identify feasible short-term (e.g., floodplain connectivity) and long-term (e.g., changes in riparian vegetation, fish population responses) objectives that can iteratively provide feedback on restoration actions and inform future project design.

Project Timeline

Winter 2025:

- LTPBR design and permitting
- Conservation grazing management plan development

Summer/Fall 2025:

- LTPBR implementation year 1

Fall/Winter 2025/26:

- Dam removal design and permitting
- Off-channel livestock water development

Summer/Fall 2026:

- LTPBR implementation year 2
- Dam removal implementation
- Off-channel livestock water source implementation
- Year 1 of post-construction LTPBR project monitoring
- Field surveys and planning for additional LTPBR in downstream and upstream reaches



Planning, Monitoring and Outreach Project Inventory

Green Highest Priority, Score of >15 in ranking matrix

Gold Medium Priority, Score of 10-15 in ranking matrix

Purple Low Priority, Score of <10 in ranking matrix

Date updated: March 2024

Planning and Capacity

Project	Description	Project Status/Key Partners	Keywords
Develop Gilly Platform for Park County and digitize all existing 310 permits	Gilly is a software platform developed by the Four Corners Foundation to streamline 310 permitting and facilitate restoration. It automates the collection and approval process for 310 and joint application permit data. It provides a robust data collection system for inputting permits (current and historic) and gives ready access to this information, streamlining the permit process for CDs and illustrating the impacts that proposed and past permits have on river systems. It has been adopted by the Gallatin CD and is available to CDs around the state. Funding and support are needed for capacity for Park County adaptation of Gilly, and data entry of all past 310 permits.	Status uncertain – Park CD	Planning; Innovation; Capacity
Create Watershed Restoration Plan for Upper Yellowstone Watershed	In order to be eligible for 319 funds, watersheds must have a MT DEQ approved Watershed Restoration Plan (WRP). DEQ is currently assessing TMDLs along the Yellowstone River but to date, has done little to no water quality monitoring of tributaries in the Upper Yellowstone. There is currently no WRP in place for the Upper Yellowstone Watershed.	DEQ is currently working on TMDLs; Upper Yellowstone Watershed Group is key partner. Status uncertain.	Planning; Water Quality; Stream and Riparian Condition; Restoration
Update Watershed Restoration Plan for Shields Watershed	The Shields WRP was completed in 2012 and has not been reviewed or updated since that time. A WRP is typically intended to be a living document that once developed, should be reviewed and reworked, if appropriate, about once every five years. The Shields WRP is overdue for a review and update.	Shields Watershed Group – no movement to date.	Planning; Water Quality; Stream and Riparian Condition; Restoration



Education

Project	Description	Project Status/Key Partners	Keywords
Beaver Conflict Resolution Program	Beavers are an integral component of healthy riparian ecosystems, but are often considered a nuisance, due to their tendency to dam culverts and irrigation systems, or cut trees. A program to demonstrate non-lethal conflict resolution methods for Region 3 will 1) provide a cost-share and technical assistance program for landowners/land managers who experience beaver-related conflicts; 2) train local partners on how to assess beaver conflict and address them with appropriate mitigation strategies; 3) develop a strong working relationship with Montana Fish Wildlife and Parks (FWP), as a basis for a broader, longer-term beaver conflict resolution program linked to larger scale beaver restoration goals. This program will be modeled after a successful program in FWP Region 2 (Missoula).	NWF is currently hiring a technician for 2024. MFP and FWP are local partners.	Education, Community Outreach, Wildlife Conflict Mitigation, Restoration
Watershed tour to showcase existing and ongoing restoration projects	Watershed tour for partners and interested landowners to showcase existing, ongoing, and planned projects. Goals would be to educate landowners on a range of restoration treatment options, inspire new projects, build community support around ongoing and planned efforts, and increase collaboration between partner organizations/ agencies. Could be hosted by the Upper Yellowstone and Shields watershed groups and modeled after summer 2022 water monitoring and invasive weed education field days.	No movement to date. Key partners are: Shields and Upper Yellowstone Watershed Groups, Park CD, MFP, TU, FWP, USFS	Education, Community Outreach

Flood Resilience

Project	Description	Project Status/Key Partners	Keywords
Channel Migration Zone mapping updates for Park Co. following the 2022 flood	Channel migration zone (CMZ) mapping for almost the entire Yellowstone River (Gardiner to Missouri River confluence) was completed in 2009. CMZ maps should be updated to reflect the dramatic changes to the river from the 2022 flood. For example, the erosion buffer mapped for the 100-year time frame did not predict the dramatic bank erosion that occurred in a 500-year flood and bank lines have moved. Erosion rates and bank lines need to be updated. Channel migration zone mapping should also be done for the Shields, Boulder, and Yellowstone River upstream of the park boundary (Cooke City area). There	In Progress (MT DNRC RDGP Grant received) – Park County, MFP	Flood Resilience, Hazard Mitigation, Planning, Channel Migration Zone Mapping



also may be opportunities to collaborate with Yellowstone National Park to get the CMZs near important roads/infrastructure mapped within the Park, which haven't been mapped yet.

Education campaign around updated CMZ mapping

Develop educational materials, user-friendly website, and presentations to educate local decision makers, riverside landowners, realtors, and the general public about how to use CMZ mapping to make decisions about infrastructure placement and risk. Educational workshops and coordination with City and County offices, staff and elected officials to teach people how to use the CMZ mapping application, how to interpret the CMZ data and basic river processes; and to explain how the CMZ application can be used as a tool for infrastructure, development, public safety, and hazard mitigation planning, as well as a prioritization and selection for future flood hazard mitigation projects. Example from CO:
<https://storymaps.arcgis.com/stories/0892249499894dc19a8726c4145ddaf9>

In progress – public meetings are planned for 2024 when draft map is complete. Key partners include: MFP, Park County, City of Livingston, Park CD, PCEC

Flood Resilience, Hazard Mitigation, Planning, Channel Migration Zone Mapping

Evaluate opportunities for city/county acquisition of floodplains, floodplain reconnection, and/or channel migration easements

The 2022 flood highlighted the importance of intact floodplains for slowing and spreading out water to reduce damage to life and property. Post-disaster hazard mitigation funding may be available to help the City/ County acquire key floodplain properties and conduct active restoration to attenuate future flood flows. These properties could be public green spaces or privately-owned agricultural lands. Floodplain or channel migration easements are another option to compensate landowners for keeping floodplains intact. See Colorado example here:
<https://storymaps.arcgis.com/stories/0892249499894dc19a8726c4145ddaf9>

In progress as part of CMZ grant – key partners include: Park County, City of Livingston, FEMA, USACE Silver Jackets, NRCS, MFP

Planning, Flood Resilience, Floodplain Reconnection, Restoration, Hazard Mitigation



MONTANA
**FRESHWATER
PARTNERS**

Upper Yellowstone River Assessment Committee (UYRAC)	After the June 2022 flood the Upper Yellowstone River Advisory Committee (UYRAC) was formed in partnership with the Upper Yellowstone Watershed Group to assist landowners with flood recovery, develop educational resources for the public, navigate the permitting process, and assist the community in making critical decisions to boost flood resiliency.	Ongoing	Planning, Education, Flood Resilience, Flood Recovery, Floodplain Reconnection, Restoration
Evaluate eight blocked side channels identified from Governor's Task Force for reconnection/restoration opportunities	Eight blocked side channels on the mainstem of the Yellowstone River were identified within Park County as part of the Governor's Task Force/ Cumulative Effects Study. These side channels should be evaluated for restoration/reconnection opportunities with willing landowners.	No movement to date. MFP, Private Landowners	Planning, Floodplain Reconnection, Restoration
Develop a story board to highlight the economic costs of flood disasters on Park Co.'s top industries	This was a suggestion from the State Hazard Mitigation Officer, Sara Hartley. After the destructive 2013 floods in Colorado, several communities put together story boards to highlight the economic impact of natural disasters on communities and their dominant industries (extraction, tourism, etc.). Future climate models were incorporated to show increasing risk of disaster with climate change. This helped generate buy-in among community members and local decision makers on disaster mitigation projects (flood, drought, fire). The Park Co. version could be presented as part of the City/County coordination and education process to generate the political will behind incorporating flood risk hazard into multiple aspects of the City/County planning process. Also include presentations/outreach to the public as needed. https://storymaps.arcgis.com/stories/4e653ffb2b654ebe95848c9ba8ff316e	No movement to date...PCEC, MFP, MT DES, Park County, City of Livingston	Education, Community Outreach, Flood Resilience, Planning



Monitoring and Assessment

Project	Description	Project Status/Key Partners	Keywords
<p>Study to assess impacts of new development (septic tanks and wells) on water quality and quantity</p>	<p>Park County is experiencing rapid growth, with most new construction occurring outside city limits. We do not have a good understanding of the effect of new wells and septic systems on our water quality and quantity. A study could help inform where new development is permitted, and best practices for well and septic systems.</p>	<p>No movement to date. City of Livingston (Public Works), DEQ</p>	<p>Research; Water Quality; Water Quantity</p>
<p>Culvert/Crossing Inventory</p>	<p>Hundreds of stream and river crossings (culverts and bridges) exist throughout the Upper Yellowstone and Shields Watersheds. Improperly sized and poorly designed crossings can act as barriers to fish and other aquatic organisms, contribute to decreased floodplain connectivity, cause unnatural erosion and sedimentation, and present a safety risk to people and property. An inventory of crossings is needed to identify and prioritize maintenance, replacement, and removal needs. Trout Unlimited recently developed an app that can be used by citizen scientists to collect information and photos about crossing structures in the Gallatin Watershed. This effort could be easily expanded to the Upper Yellowstone Watershed. There are a number of highways, county, and private bridges on the mainstem of the Shields River that need to be evaluated.</p>	<p>MFP completed assessment of culverts/ bridges under HWY 89 from Livingston to Gardiner for fine scale assessment. More work is needed to evaluate crossings on other roads/ private lands. TU, MT FWP, Center for Large Landscapes</p>	<p>AOP; Restoration; Connectivity; Native Fish</p>



MONTANA
**FRESHWATER
PARTNERS**

**Fishing access needs
assessment**

Recreational use of the Upper Yellowstone River has increased dramatically in recent years and in some cases may be outpacing the ability of existing fishing access points to accommodate current and future levels of use. The Upper Yellowstone Watershed Group has recently undertaken a recreational use study to develop a baseline on river use (who, what, where) in order to inform future recreation management on the Upper Yellowstone River. A needs assessment of fishing/river access points would inform where upgrades of infrastructure (waste, boat ramps, educational signage, parking) are most urgent. Areas where resource degradation is occurring could also be identified for restoration (riparian plantings, people management, etc.).

Ties into Recreational Use Study led by UYWG. Status uncertain. MT FWP, Upper Yellowstone Watershed Group, MFP

Recreation Management; Assessment

**General Fish
Distribution Monitoring**

Up to date information on fish distribution/ populations does not exist for many tributaries throughout both watersheds. Where possible, fish monitoring should be added as a component of restoration projects.

TU and MFP have conducted fish community/ occupancy e-fishing surveys on Hammond, Willow, Bangtail, Crazy Head, Brackett, Canyon Creeks in the Shields. Additional work with FWP is needed.

Native Fish; Monitoring

Repeat of cutthroat spawning study (De Rito et al. 2004)

MSU telemetry study of fluvial cutthroat, rainbow, and cutthroat/rainbow trout hybrid spawning in mainstem, side-channels, and tributaries of the Yellowstone from Springdale to Gardiner. 89% of tagged fish spawned in waterways within private lands. Main finding was that difference in timing of spawning (temporal segregation) was the main factor maintaining reproductive isolation between cutthroat and rainbow trout with cutthroat spawning later. Study should be repeated to track changes in levels of introgression, changes in spawning timing and location to inform management and restoration priorities.

No movement to date. Several ongoing MSU graduate student and USGS studies are in progress – update is needed. MSU, USGS, MT FWP

Native Fish; Monitoring

Upper Yellowstone & Shields Restoration Project Inventory



- Green** Highest Priority, Score of >15 in ranking matrix
- Gold** Medium Priority, Score of 10-15 in ranking matrix
- Purple** Low Priority, Score of <10 in ranking matrix

Yellowstone River

Project		Keyword
Mill Creek RM 7.2 – 10.3	This project will reconnect a broad floodplain and increase channel complexity, improving natural water storage and fish and wildlife habitat. The first of three planned phases of this project is in process but additional funding is needed for future phases.	Floodplain Connectivity; Yellowstone Cutthroat; Stream and Riparian Condition; Flood and Drought Resiliency; Water Quality
Sixmile Creek RM 1.5-2	An undersized culvert on Mule Deer Road constricts Sixmile Creek and is at risk of failure during high streamflow events. During the June 2022 flood, erosion around the culvert nearly caused the road to wash out. The culvert is perched and is causing Sixmile Creek to become extremely incised downstream. This project would entail replacing the undersized culvert with appropriate crossing to improve fish passage, reduce sediment inputs and allow for stream-floodplain connectivity. Ideally, this project would be coupled with stream restoration downstream of the crossing.	Aquatic Organism Passage Floodplain Connectivity; Yellowstone Cutthroat; Stream and Riparian Condition; Flood and Drought Resiliency; Water Quality

Sixmile Creek RM 0-1.5	<p>Sixmile Creek is extremely unstable after the 2013 Emigrant Peak Fire and high flows in 2022. There are several active headcuts and the creek is becoming increasingly straightened and incised. Wood has been actively removed from the channel and the riparian area has been degraded due to lack of floodplain connectivity, grazing impacts and a lowered water table. This project would restore up to 1.5 miles of stream; actions would include stabilizing or reversing headcutting, restoring floodplain connectivity and riparian revegetation, and increasing natural water storage. Potential exists to evaluate and possibly replace undersized or perched culverts and to construct livestock exclusion fencing. These actions would improve fisheries habitat and passage, and wildlife habitat.</p>	<p>Aquatic Organism Passage Floodplain Connectivity; Yellowstone Cutthroat; Stream and Riparian Condition; Flood and Drought Resiliency; Water Quality</p>
Trail Creek RM 4.9 – 10.6	<p>Trail Creek bifurcates just upstream of Old Yellowstone Trail and both branches have become straightened and incised with little to no riparian corridor. Park Branch Canal intercepts both branches of Trail Creek and captures most of the water leaving Trail Creek with no direct connection to the Yellowstone. Restoration goals include improving fish and riparian habitat in Trail Creek by consolidating flows into a single restored channel with a connected floodplain and evaluating options to prevent fish entrainment in the PBC. Potential exists to remove non-native fish and establish a genetically unhybridized population of YCT. Numerous diversions and water rights makes this a complex project.</p>	<p>Aquatic Organism Passage Floodplain Connectivity; Yellowstone Cutthroat; Stream and Riparian Condition; Flood and Drought Resiliency; Irrigation</p>
Fleshman Creek RM 5.2-5.7	<p>This project is on state land just upstream of Livingston. The property is leased for grazing and has been severely overgrazed in the riparian corridor and adjacent upland. The creek is incising and is disconnected from its floodplain in areas. Project goals are to increase stream-floodplain connectivity and natural water storage, increase instream complexity and sinuosity, and restore a native riparian vegetation community. This is an excellent opportunity for floodplain reconnection through beaver mimicry, PALS or other similar techniques and targeted riparian plantings/application of various RCG management techniques. This project is close to town and is on public land, so it provides an excellent opportunity for outreach and education as a demonstration project.</p>	<p>Aquatic Organism Passage Floodplain Connectivity; Stream and Riparian Condition; Flood and Drought Resiliency; Water Quality</p>
Upper Eightmile Creek Restoration	<p>This project is on a private ranch upstream of Old Yellowstone Trail that contains over 5 miles of Eightmile Creek. The creek is oversimplified, lacking in riparian vegetation, and is moderately incised in some areas, with a well-developed inset floodplain in other areas. It has been severely overgrazed by past livestock use. The current landowners are planning to fence cattle out of the riparian corridor and are interested in stream restoration. They aren't using their full water right in order to leave water instream for native fish and would be potentially interested in partnering with Trout Unlimited or FWP on a water lease. A restoration project at this location would entail floodplain reconnection in targeted areas, significant riparian planting efforts and the addition of</p>	<p>Floodplain Connectivity; Yellowstone Cutthroat; Stream and Riparian Condition; Flood and Drought Resiliency; Water Quality</p>

instream structures to add habitat complexity for native fish. Past development of stream-adjacent ponds within the ranch and potential historic stocking of non-native fish necessitate further fish sampling prior to investment in restoration. There is also the potential to bundle this project with restoration efforts on Lower Eightmile Creek and upgrades to the Eightmile Creek Culvert under Highway 89, resulting in much larger scale benefits.

Eightmile Creek Hwy 89 Culvert

Eightmile Creek is a large tributary to the Yellowstone River, originating in the Gallatin Mountains and draining an approximately 41 square mile watershed above the highway 89 crossing. According to the FISHMT database, brook trout, brown trout, cutthroat trout, mountain whitefish, and rainbow trout have all been detected during electrofishing surveys both above and below the HWY 89 crossing. Fluvial Yellowstone cutthroat trout have the potential to use Eightmile Creek as a spawning reach, and a single Yellowstone cutthroat was documented spawning above the HWY 89 crossing in the early 2000's (DeRito et al 2004). The HWY 89 crossing is a large elliptical metal culvert with little to no natural substrate in the bottom of the culvert. The outlet is perched, with water falling onto a cascade of boulders. At some flows, this cascade likely forms a series of step pools that fish can navigate, but at other flows it probably functions as a fish barrier. The culvert span is narrower than the bankfull width of the stream, resulting in high velocity flows in the culvert. The upstream end of the culvert was being undermined by water eroding around the culvert, which was repaired in spring of 2023 using a combination of fill, riprap, and coir fabric. The culvert is not flow aligned, so this problem is likely to persist. This project would be in partnership with Yellowstone Safe Passages and would entail replacing the culvert with a bridge that would not only accommodate the stream and its floodplain, but also provide terrestrial passage.

Aquatic Organism Passage
Floodplain Connectivity;
Yellowstone Cutthroat;
Stream and Riparian
Condition;
Flood and Drought
Resiliency; Water Quality

Yellowstone River HWY 89N Bridge

The Highway 89N Bridge over the Yellowstone River east of Livingston is undersized, forcing the river to make a 90 degree turn upstream of the bridge and increasing erosion and avulsion risk for property owners up and downstream. The bridge needs to be evaluated and replaced with a wider structure to accommodate the river and its floodplain.

Infrastructure;
Transportation; Floodplain
Connectivity; Flood
Resiliency; Hazard
Mitigation

Yellowstone River Point of Rocks Bridge

The Point of Rocks Bridge is undersized and was severely damaged in the 2022 flood. MDT completed a quick fix, but a long-term solution is needed. Increasing bridge span would reduce flood risk to infrastructure, increase floodplain connectivity along the Yellowstone River, and could increase connectivity for wildlife under the highway.

Infrastructure;
Transportation; Floodplain
Connectivity; Flood
Resiliency; Hazard
Mitigation

Yellowstone River BNSF Railroad Bridge	<p>The BNSF railroad bridge parallel and immediately downstream of the HWY 10/89 South Bridge over the Yellowstone on the east end of Livingston has a narrow span and serves as a pinch point, which likely contributed to 2022 flooding on the east end of Livingston. The parallel highway bridge was replaced in 2013 with a wider span and taller structure, but contrary to the recommendation of the Governor's Upper Yellowstone Task Force, the railroad bridge was not replaced at the same time. The railroad bridge should be evaluated and replaced with a zero-backwater design to allow for more floodwater passage through town and increased floodplain connectivity. This project has a high community benefit and would decrease flood risk in the town of Livingston. It would provide some additional floodplain connectivity for the Yellowstone River but relative to other projects, would likely have a low-moderate ecological footprint.</p>	<p>Infrastructure; Transportation; Floodplain Connectivity; Flood Resiliency; Hazard Mitigation</p>
Yellowstone River Carters Bridge	<p>Carters bridge is undersized and creates a pinch point along the river and floodplain, impounding sediment and concentrating flows just upstream of Livingston. The bridge should be evaluated and possibly replaced with a wider span/ zero backwater design. Increasing bridge span would reduce flood risk and increase floodplain connectivity along the Yellowstone River. Feasibility and MDT interest are unknown.</p>	<p>Infrastructure; Transportation; Floodplain Connectivity; Flood Resiliency; Hazard Mitigation</p>
Yellowstone River Emigrant Bridge	<p>Emigrant bridge is undersized and creates a pinch point along the river/floodplain, impounding sediment and concentrating flows just upstream of Livingston. The bridge should be evaluated and possibly replaced with a wider span/ zero backwater design. Increasing bridge span would reduce flood risk and increase floodplain connectivity along the Yellowstone River. Feasibility and MDT interest are unknown.</p>	<p>Infrastructure; Transportation; Floodplain Connectivity; Flood Resiliency; Hazard Mitigation</p>
Lower Eightmile Creek Restoration	<p>Lower Eightmile Creek was historically overgrazed and its floodplain has more recently been subdivided into multiple 5-20 acre parcels. The stream is oversimplified, lacks a riparian corridor and is moderately incised in some areas, with a well-developed inset floodplain in other locations. One landowner along Lower Eightmile Creek has had a long-term interest in restoring the stream through his property and adjacent properties. He has been in coordination with his neighbors about partnering on a multi-property project. Treatments would involved riparian revegetation and the addition of some instream structures to add instream complexity and expand the riparian zone for fish and wildlife.</p>	<p>Aquatic Organism Passage Floodplain Connectivity; Yellowstone Cutthroat; Stream and Riparian Condition; Flood and Drought Resiliency; Water Quality</p>

Mill Creek Fish Barrier at RM 14

This project would involve constructing a fish barrier to protect the genetically unhybridized YCT population in the Mill Creek headwaters from hybridization with rainbow trout and competition with brook trout. Through private, non-profit, state, and federal collaboration, this project would protect up to 11.5 stream miles of intact healthy habitat for an important YCT core conservation population and contribute to the range-wide conservation of YCT.

Yellowstone Cutthroat;
native fish;
invasive species;

Yellowstone River Bank Erosion

Many landowners along the Upper Yellowstone experienced dramatic bank erosion and land loss due to the 2022 flood and are interested in funding and technical assistance with bank stabilization. Restoration goals include identifying individual project locations, working with landowner to increase floodplain connectivity, stabilize bank through bioengineering treatments and revegetation, reduce livestock impacts to riparian vegetation through fencing and grazing management.

Bank stabilization;
Bioengineering;
Water Quality;
Grazing management;
Stream and Riparian Condition;
Floodplain connectivity; Flood Resilience

Yellowstone River, Park Branch Canal

The Park Branch Canal provides water to numerous producers in the northern half of the Paradise Valley. The side channel where the Park Branch Canal diversion is located was captured by the main river during the 2022 flood, causing extensive erosion and threatening the diversion structure. An alternatives analysis is needed for a long-term solution for the Park Branch Canal, and a fish screen on the headgate should be considered.

Irrigation;
Native fish;
Water supply

Shields River

Project

Keyword

Willow Creek RM 0 – 3.9

Much of Willow Creek has been overgrazed and/or farmed within the riparian corridor throughout this reach. As a result, the channel is incised and the riparian corridor lacks understory vegetation. Reed canarygrass has become prevalent throughout much of the reach. This reach contains multiple undersized culverts and a reservoir holding back water with an earthen dam and headgate. Restoration goals include managing grazing in the riparian area, reconnecting the incised channel to its floodplain, and improving riparian vegetation. Potential treatments could include cattle exclusion fencing, off-channel watering or water gaps, planting native riparian species and instream treatments like large wood, PALs or BDAs. Multiple culverts could be upgraded to accommodate the creek and its floodplain. There is also a private reservoir within this reach that could be evaluated for water conservation/ management opportunities.

Floodplain Connectivity;
Yellowstone Cutthroat;
Stream and Riparian Condition;
Flood and Drought Resiliency; Water Quality;
Aquatic Organism Passage; Weed Management; Grazing Management

**Hammond Creek RM
0.5 – 6.1**

This is a long reach (over 5 miles) of Hammond Creek. The lower mile of the identified project is on private property and the remainder is owned and managed by a subsidiary of the Yellowstone Club. The creek is heavily incised and is completely lacking in riparian vegetation for much of the reach. There are also some culverts that appear to be undersized and potentially need to be upgraded for native fish passage and increased floodplain connectivity. Project goals are to increase stream-floodplain connectivity and natural water storage, increase instream complexity and sinuosity, and restore a native riparian vegetation community. This is an excellent opportunity for floodplain reconnection through beaver mimicry, PALs or other similar techniques and targeted riparian plantings/application of various RCG management techniques. There is also a private reservoir within this reach that could be evaluated for water conservation/management opportunities.

Floodplain Connectivity;
Yellowstone Cutthroat;
Stream and Riparian
Condition;
Flood and Drought
Resiliency; Water Quality;
Weed Management;
Grazing Management;
Water Quantity

**Bangtail Creek RM 0-
2.15**

Bangtail Creek has several impairments throughout this reach. The culvert that allows Bangtail to go underneath Hwy 89 before emptying into the Shields River is perched, and there are multiple other culverts that appear to be undersized and need to be evaluated for fish passage. There are also several sections of stream within this reach that have been overgrazed and are incising, disconnecting the stream from its floodplain. Many of these areas are lacking in riparian understory. Project goals include improved grazing management in riparian areas, reconnecting the incised channel to its floodplain, and improving riparian vegetation. Potential treatments include cattle exclusion fencing, off-channel watering or water gaps, and instream treatment like large wood, PALs or BDAs. The project would likely entail replacing perched and/or undersized culverts with larger, bottomless culverts to allow for increased stream-floodplain connectivity.

Floodplain Connectivity;
Yellowstone Cutthroat;
Stream and Riparian
Condition;
Flood and Drought
Resiliency; Water Quality;
Aquatic Organism
Passage; Weed
Management; Grazing
Management

Bangtail Creek RM 3-4.8

Bangtail Creek is incised throughout this reach (over 6 ft in some locations) with a moderately intact riparian area and an undersized/perched culvert that is a likely barrier to fish passage. Project goals include enhancing stream-floodplain connectivity and water storage and managing livestock grazing to prevent future degradation of the creek. A series of beaver dam analogs (BDAs) and post assisted log jams (PALs) would aggrade the stream and help reconnect to the floodplain, and trap fine sediment to improve spawning gravels. If livestock will be present, exclusion fencing and off channel water sources should be considered, with the riparian zone being an option for late-season, low-duration forage. Culvert replacement should be considered.

Floodplain Connectivity;
Yellowstone Cutthroat;
Stream and Riparian
Condition;
Flood and Drought
Resiliency; Water Quality;
Aquatic Organism
Passage; Weed
Management; Grazing
Management

Canyon Creek RM 1.5-12

This project is a mix of state and private ownership. Assuming the state would be interested in partnering on this project, this project would restore floodplain connectivity for over 10 miles. Upgrading multiple perched culverts could also restore passage for native YCT. The goals for this project would be to enhance stream-floodplain connectivity and water storage (drought and flood resiliency) and to manage livestock grazing to prevent future degradation of the creek. A series of beaver dam analogs (BDAs) and post assisted log jams (PALs) would aggrade the stream and help reconnect to the floodplain, and trap fine sediment to improve spawning gravels. If livestock will be present, exclusion fencing and off channel water sources should be considered, with the riparian zone being an option for late-season, low-duration forage.

Floodplain Connectivity;
Yellowstone Cutthroat;
Stream and Riparian
Condition;
Flood and Drought
Resiliency; Water Quality;
Aquatic Organism
Passage; Weed
Management; Grazing
Management

Flathead Creek RM 16.1-16.9 and 17.3 to 18.1

Flathead Creek, a tributary to the Shields River, supports a population of Yellowstone Cutthroat Trout (YCT) that contributes to the high conservation value of the YCT population in the Shields River Watershed (Endicott et al. 2012). The value of stream restoration on the Shields River and its tributaries, such as Flathead Creek, is high considering their potential to support and sustain genetically unaltered populations of YCT. Within this reach of Flathead Creek, the stream is degraded due to past cattle grazing activities and encroachment of agricultural activities up to the streambanks. These pressures have resulted in stream channelization and incision, a diminished riparian area, reduced channel length due to multiple minor avulsions (meander cutoffs), bank instability and lateral erosion, and elevated sediment delivery to the stream. The Shields River is listed on the state of Montana's list of impaired 303(d) waters due to physical and ecological impacts related to sediment (SVWG, 2012). Streambank erosion was identified as one of the primary mechanisms for sediment delivery to the Shields River and its tributaries. Therefore, restoration projects aimed at restoring and protecting riparian buffers as well as natural channel morphology, instream habitat complexity and floodplain connectivity are important to improve fish habitat for Flathead Creek YCT as well as reduce sediment loading in the Shields Watershed. This project will improve stream-floodplain connectivity and instream fish habitat, while also revegetating and expanding riparian areas to increase stream shading and reduce unnatural, elevated erosion rates. Techniques employed in this project will include composite wood-toe installations coupled with a constructed bankfull bench to prevent further degradation and to stabilize bank margins. Bankfull benches will be planted native vegetation including willow live stakes (cuttings) as well as containerized plantings to add further stability.

Floodplain Connectivity;
Yellowstone Cutthroat;
Stream and Riparian
Condition;
Flood and Drought
Resiliency; Water Quality

Kay Creek RM 1.1-4.7	<p>Kay Creek has been severely overgrazed and is lacking in riparian trees/shrubs throughout much of this reach. Calving corrals are located within the riparian corridor and a diversion delivers water to Willow Creek. Project goals include improving riparian grazing management and reconnecting the incised channel to its floodplain. Potential treatments include cattle exclusion fencing, off-channel watering or water gaps, and instream treatment like large wood, PALs or BDAs. Additionally, opportunities for water conservation, such as eliminating the diversion off Kay Creek, could be evaluated as part of this project.</p>	<p>Floodplain Connectivity; Yellowstone Cutthroat; Stream and Riparian Condition; Flood and Drought Resiliency; Water Quality; Aquatic Organism Passage; Weed Management; Grazing Management</p>
Shields River RM 29.5-31.9	<p>The Shields River is incised and has very vertical banks in several areas throughout this reach, resulting from overgrazing cattle/farming up to the river's edge. These banks are contributing to the elevated sediment load for the 303d listed Shields River. The banks are also lacking in riparian trees/shrubs in these locations. The goal of this project would be to increase river-floodplain connectivity and reduce sediment load to the Shields River, which is listed on the DEQ 303d list for elevated sediment loads. Additionally, we would like to increase riparian tree/shrub cover and riparian shading in these areas. The landowner is interested in doing some sort of bioengineered bank treatment along vertical banks as well as a floodplain reconnection project to reduce pressure in areas along these banks by reconnecting old side channels/oxbows on river left.</p>	<p>Floodplain Connectivity; Yellowstone Cutthroat; Stream and Riparian Condition; Flood and Drought Resiliency; Water Quality; Weed Management; Grazing Management</p>
Horse Creek RM 6.1 – 6.4	<p>Horse Creek has been overgrazed and incised within two adjacent private properties and reed canary grass is prevalent, particularly in areas with reduced canopy cover. Native riparian vegetation includes decadent willows, with little to no juvenile tree/shrubs. RCG is becoming increasingly prevalent at this site and throughout the Horse Creek drainage. The goals of this project would be to increase stream-floodplain connectivity and natural water storage while reducing RCG cover and enhancing native species diversity and cover. This is a great opportunity to not only restore channel morphology/hydrology but to try to different restoration techniques aimed at RCG management that have worked in other parts of the state. Work by partners has shown that RCG management requires a multipronged approach. Restoring hydrology through floodplain reconnection with low-tech treatments (e.g. BDAs or PALs) should make conditions more favorable for native vegetation over RCG. Other management techniques that could be utilized include fencing exclosures with weed mat and native plantings, controlled burning and/or mechanical management.</p>	<p>Floodplain Connectivity; Yellowstone Cutthroat; Stream and Riparian Condition; Flood and Drought Resiliency; Water Quality; Weed Management; Grazing Management</p>

**Indian Creek RM 0 –
1.05**

Indian Creek is a smaller tributary to the Shields River that has been overgrazed and trampled by cattle throughout this stretch. As a result, it is incised/lacking in riparian cover. The goal of this project would be to increase stream-floodplain connectivity and water storage and to restore a diverse riparian plant community. The project could entail a grazing management plan, fencing and water gaps to keep cattle out of the stream, active plantings of native riparian species and low tech processed based restoration like BDAs or PALs. It is a small tributary to the Shields (only a few feet wide) so this type of restoration would work really well to slow down and store more water.

Floodplain Connectivity;
Yellowstone Cutthroat;
Stream and Riparian
Condition;
Flood and Drought
Resiliency; Water Quality;
Weed Management;
Grazing Management

**Shields River RM 58.5-
59.9**

Both lower Bennett Creek and the Shields River burned severely during the 2021 American Fork Fire and are experiencing high volumes of sediment transport. They are prone to channel incision throughout this area and have reduced riparian shading as a result of the fire. The goal of this project would be to reduce the likelihood of further incision by adding roughness throughout the stream and floodplain. These reaches of Bennett Cr and the Shields River would greatly benefit from low-tech process-based restoration such as PALs for the mainstem and BDAs for Bennett Creek to assist with trapping sediment and slowing down erosion/incision. These treatments would help to improve stream-floodplain connectivity over time, helping native riparian vegetation to recolonize the area. The project could also include active plantings in areas to help kickstart revegetation of the riparian area.

Floodplain Connectivity;
Yellowstone Cutthroat;
Stream and Riparian
Condition;
Flood and Drought
Resiliency; Water Quality;
Weed Management;
Grazing Management

**Brackett Creek RM 5.5 –
7.5 and 7.6 - 9.4**

Due to historic land use and a wooden bridge crossing and confining the channel within the project area, Brackett Creek has a high level of instability and many high, eroding banks on outside bends, contributing excess fine sediment to the channel, limiting deep pool habitats, and creating potential for further channel degradation. This instability is leading to loss of downstream habitat due to sediment input and channel avulsion. The purpose of this project is to prevent continued erosion into the access road and field on river right, and to increase watershed resilience and protect and improve wild and native fish habitat by re-sloping and revegetating eroding banks to increase floodplain connectivity, instream complexity, and riparian shading. This project would include use of bioengineered bank treatments to achieve the outcomes of decreasing erosion, reconnecting the stream to its floodplain, and improving aquatic habitat for native and wild fish.

Floodplain Connectivity;
Yellowstone Cutthroat;
Stream and Riparian
Condition;
Flood and Drought
Resiliency; Water Quality

Crazy Head Creek RM 2 – 4.9	Crazy Head Creek is a small, groundwater fed stream that has been overgrazed and is lacking in riparian trees/shrubs throughout this reach. It is downcut throughout the reach, although less severely than adjacent tributaries (Willow, Kay, and Bangtail) because it is groundwater fed. The goals for this reach would be to find ways to manage grazing in the riparian area and to reconnect the incised channel to its floodplain and increase overbank flows to allow native riparian trees and shrubs to regenerate. This reach could benefit from a grazing management plan, riparian fencing and potentially off-channel watering or water gaps. Additionally, beaver dam analogs would be an excellent treatment for bringing the streambed back up and reconnecting the channel with its floodplain.	Floodplain Connectivity; Yellowstone Cutthroat; Stream and Riparian Condition; Flood and Drought Resiliency; Water Quality; Weed Management; Grazing Management
Adair Creek RM 0.65 - 1.25 & Bull Run RM 0 - 0.25	Bull Run and Adair Creek are groundwater fed tributaries that lie within private property. Adair Creek is incised and both streams have a degraded riparian corridor. Project goals include managing grazing in the riparian area and reconnecting the incised channel to its floodplain to increase overbank flows and allow native riparian trees and shrubs to regenerate. This reach could benefit from a grazing management plan, riparian fencing and potentially off-channel watering or water gaps. Beaver dam analogs would be an excellent treatment to aggrade the streambed and reconnect the channel with its floodplain.	Floodplain Connectivity; Yellowstone Cutthroat; Stream and Riparian Condition; Flood and Drought Resiliency; Water Quality; Weed Management; Grazing Management
Shields River, HWY 89 Bridges	Both US Highway 89 bridges that cross the Shields River are very undersized and force the Shields River to take a ninety degree turn upstream of the bridges to meet their span. They are also resulting in severe downcutting of the river. The goal of these two projects would be to improve stream-floodplain connectivity for the Shields River, encouraging overbank flows, enhanced riparian vegetation and improved connectivity for fish and wildlife species. The project would entail replacing the current bridges with two larger span bridges that accommodate more of the river and its adjacent floodplain. Additional treatments could include riparian plantings as well as placement of large wood both instream and on the floodplain to improve connectivity and hiding cover for native species.	Floodplain Connectivity; Stream and Riparian Condition; Flood and Drought Resiliency; Infrastructure; Transportation
Shields River (Chadbourne Diversion)	In 2011 and again in 2021, FWP collaborated with the Lower Shields River Canal Company to repair and retrofit the Chadbourne Diversion, maintaining it as a barrier to the upstream movement of rainbow trout and protecting the relatively genetically pure populations of YCT upstream from hybridization. A potential project that would build upon this work is to install a bypass channel to allow for selective passage of fishes. The channel would lead to a stock pen, where an FWP technician could then identify fish ascending the ladder and sort them, placing native fishes upstream and returning rainbow trout downstream of the diversion to restore connectivity and promote migratory life history strategies for native fish species.	Native Fish; Yellowstone Cutthroat; non-native fish

Shields River RM 48.7-49.6

This reach of the Shields River has been overgrazed to the edge of the river in several areas and is lacking in riparian vegetation. There are multiple exposed vertical banks that are contributing sediment to the Shields River which is listed for elevated sediment on the 303d list. There is also a bridge within this stretch of river that was developed for a railroad trestle and is significantly undersized for the Shields River. As a result, it is causing the river to incise, disconnecting it from its floodplain. The goal of this project would be to reduce livestock impacts to the river and increase stream-floodplain connectivity and native riparian plant diversity and cover. This could be done in a number of ways including 1) removing the railroad trestle bridge installing a larger span bridge that accommodates more of the floodplain, 2) reconnecting old side channels using large wood, 3) bioengineered treatments/revegetation on exposed vertical banks and 4) managing grazing through a management plan, exclusion fencing and water gaps or off-channel watering.

Floodplain Connectivity;
Stream and Riparian
Condition;
Flood and Drought
Resiliency; Water Quality;
Weed Management;
Grazing Management

Shields River RM21-21.6

The MRL railroad dike confines and channelizes this portion of the Shields River, causing the river to incise throughout this reach and sending the river directly towards private property downstream, where it is causing very unnatural erosion/vertical banks to form and increasing fine sediment inputs into the Shields River. The goal of this project would be to increase stream-floodplain connectivity and reduce sediment loads. The most ideal project would be to remove the railroad dike and allow the river to reclaim its natural floodplain which would likely entail removing dike material, regrading, and creating roughness instream and on the floodplain in the form of large wood. The current landowner does not seem to be on board with this project. If dike removal is not feasible, a second option would be to reconnect existing side channel/oxbow habitat on river-right, allowing the river to have more space and reducing the firehose effect of the main channel. With either approach, it would be ideal to scale back the bank of the downstream affected landowner and install some type of bioengineered treatments (wood, willow-lifts, etc.) to reduce sediment load to the Shields River and flood risk to the home. The rating for this project assumes the second option, if dike removal becomes possible the low priority rating would increase to high priority.

Floodplain Connectivity;
Water Quality
Stream and Riparian
Condition;
Flood and Drought
Resiliency

Shields River RM 38.1-38.65

This reach of the Shields River decadent cottonwood and aspen, but the understory has been overgrazed and trampled. As a result, there are multiple areas of vertical banks and unnatural 90-degree bends on the river, contributing sediment to the Shields River, which has been listed on the DEQ 303d for elevated sediment. The goal of this project would be to reduce livestock impacts to the river and increase stream-floodplain connectivity and native riparian plant diversity and cover. This could be done through updated grazing management, exclusion fencing, water gaps or off-channel watering. Additionally, scaling the bank back in areas and using bioengineered treatments (e.g. willow-lifts, large wood, etc.) would help to reduce the sediment load to the Shields and enhance stream-floodplain connectivity, however there are very few opportunities for floodplain reconnection.

Water Quality; Grazing
Management; stream and
riparian condition; Water
Quality

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